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The Telephone Industry.

This week we are able to give the U. S. Census Bureau gross figures for the American telephone industry, thus completing the series of three reports on the great branches of electrical development—lighting and traction being the other two. A very impressive showing is made by these public utilities, whose gross income for the year 1907 is reported in these statistics to reach the enormous sum of $790,000,000. Our estimate made in Jan. 2 issue, for 1908, was at least $775,000,000 for that year, but allowing an increase of 5 per cent over the whole field—it was probably thereabouts—the actual amount was not less than $825,000,000, a total very near our assumption, but little suspected, we fancy, by most of our readers. If telegraphy be added, the higher total of $900,000,000 for 1908 is reached, without the inclusion of $250,000,000 for electrical manufacturing, and over $100,000,000 for miscellaneous service and isolated plant output. Truly our electrical industries are broad-based and all pervasive in their service and beneficence!

Looked at from the standpoint of capital and of employment to labor, these three great industries again loom up respectably. The central-station industry gives a livelihood to 47,500 people, telephony to 144,000, and traction to 220,000, making a total of 411,500 persons. The cost of the central-station plants in 1907 was just $1,030,000,000; the capitalization of telephony was $1,100,000,000 and the capitalization of street railways was just upon $4,000,000,000, making a grand aggregate of $6,130,000,000, or for 1908 about $7,000,000,000. These are large figures, but will soon be eclipsed by the very process of growth which in normal years is well over 10 per cent all around.

Coming specifically to the growth of telephony, it will be seen by the table given elsewhere that the percentages show an average annual gain of 20 per cent and upward for the last five years—1902 to 1907—so that the total income shows a gain of 112 per cent; capitalization 134 per cent; employees about 80 per cent; stations 158 per cent; and messages 124 per cent. These are striking advances, due, of course, in large measure, to the competition in the field, but also to the natural expansion of a highly useful art. The number of telephone stations was 6,118,578 and the average income per station was $30, as compared with 2,371,044 stations in 1902 when the average income per station was $40. We are glad to have been accurate enough to estimate both stations and income very closely—in fact, the income exactly. The decline per station was inevitable with the vast addition of cheaper systems on a lower basis of subscription. It is not at all unlikely that the income per station may rise slowly, for it is universally felt that competitive rates have been too low, and strenuous efforts are being made to raise them.

Incidentally, the Bell system is shown to be still decidedly "on top" with about 3,200,000 of the stations, and probably a disproportionate slice of the income, for the Bell telephone

report of last year gave the earnings of the system in 1907 as $120,753,200 out of the total shown in the table of $184,461,747—two-thirds. As a matter of fact, if we are to accept the figures of the Bell report, the telephones connected into the system of all companies at the end of 1907 were 3,839,000, making again two-thirds of the apparent 6,000,000. This discrepancy is due to the fact that so many "independent" telephones are Bell connections. Another interesting point that comes out is that, on the surface, the gross telephone income was more than that of the central stations, viz., $184,461,747 as compared with $175,642,338. But it is to be borne in mind that several hundred trolley companies are also doing a lighting and power business, directly or through subsidiary corporations, and this would bring the gross lighting income well above that of telephony. The two great industries are, however, running pretty closely, neck and neck, and it will be extremely interesting to watch their relative growth.

Transformer Performance.

An article in this issue by Prof. A. C. Scott gives an instructive comparison of the performances of one-kilowatt units of certain commercial lines of transformers. Both the dimensional data and the operating characteristics serve to show that each of the five designers represented has made an independent selection of the proportions considered by him as best suited for his purposes. Thus, the weights of the core of one of the transformers is 2.5 times that of another, while the core losses vary by 25 per cent, and the copper losses by 15 per cent. In spite of these large differences, the full-load efficiencies vary by only 3 per cent, the "all-day" efficiencies by only 9 per cent. The transformer exhibiting the highest core loss has a core weighing less than one-half as much as the core of another transformer, the loss per pound in the former being nearly three times that in the latter, and yet the maximum temperature rises in the two cases differ by less than 16 per cent. The transformer having the lightest core and that having the heaviest core experience almost identical maximum temperature rises. Although the transformers tested are of relatively very recent construction, it is safe to say that, since they were built, several of the lines to which these transformers belong have been greatly improved by the substitution for older core material of the new alloy-steel, to which a considerable portion of the superior performance of one of the transformers is attributable.

All of the units are conservatively rated so far as initial temperature rise is concerned. In fact, the transformers having non-aging cores could well be rated much above 1 kw. Quite independently of the lower specific energy loss in the alloy-steel cores, the substitution of this material for cores that "age" in service should permit the builder to base the transformer rating on a higher maximum temperature rise without altering in the least the temperature to which the insulation will be subjected before destruction. For example, in a transformer rated by the manufacturer on a 50 deg. C. rise, the actual rise will reach 60 deg. C. after the transformer has been in service for some time, if the core "ages" by 40 per cent. Since a 40 per cent increase in the core loss was not uncommon at the time when an initial rise of 50 deg. C. was considered safe for the insulation, equal safety to even the old, unimproved insulation would be insured by permitting an initial 60 deg. C. rise when non-aging cores are employed. Owing to the fact that the customer is the one who in the end pays for any excess of conservatism in rating, it would seem that the permissible temperature rise of oil-insulated transformers having non-aging cores could well be increased over the value selected when the older magnetic material was employed.

Earnings Per Kilowatt of Capacity.

It has been so much the custom for those engaged in the production and sale of electric light and power to talk in terms of kilowatt-hours and the revenue per kilowatt-hour that an equally important item has been lost sight of too frequently. The item to which we refer is the gross yearly income per kilowatt of station capacity, and closely related to this is the item of gross yearly income per kilowatt of maximum demand by a consumer. Other things being equal, the cost of power plant and distributing system varies in proportion to the kilowatt capacity of the station, which factor thus governs the amount of money invested in a central-station enterprise. It is, therefore, of first importance to consider the gross revenue which is being obtained for each kilowatt of station capacity, because this item indicates the degree to which the company is utilizing its apparatus and investment. Of course, the investment represented by bonds and stock may be dependent on the condition of the company's plant, and also is dependent on the wisdom and honesty with which past investments have been made. The investment per kilowatt of capacity should be higher for a plant which is thoroughly up to date and in first-class physical condition than in a plant which is practically worn out. In the case of the worn-out plant, greater investment will soon be necessary, while in that of the plant in good physical condition, the investment is in condition to earn money for a number of years to come. Along with gross earnings per kilowatt the investment per kilowatt of equipment should also be considered.

As a common unit which every company should consider in analyzing its own operations and in comparing them with other companies the yearly revenue per kilowatt of station capacity is a most useful and instructive item. High earnings per unit of capacity almost invariably indicate good net earnings on the investment. The reason for this is that so large a portion of the actual cost of supplying electric light and power consists of certain fixed charges, such as interest on investment, depreciation and fixed losses connected with the plant which go on 12 or 24 hours per day without much regard to whether the plant is carrying full load or very light load. It is, of course, conceivable that a plant might be earning a high gross revenue per kilowatt of capacity, and yet have operating expenses in so large a proportion of the gross revenue as to yield but little net revenue. While such conditions are conceivable, in practice they are rarely found in central-station work. As with every other item entering into central-station operation, this figure of gross yearly income per kilowatt of station capacity varies greatly, the limits varying between $40 and $140.

It would benefit a great many central-station companies to go over a number of their consumers' accounts and figure out the gross yearly revenue which each consumer yields per kilowatt of capacity demanded at the time of the yearly peak load. It would open the eyes of a great many as to which are the most desirable customers. We have in mind the manager of a small company who recently applied this test to a number

of installations, with the result that he discovered that some of his supposedly insignificant lighting customers were paying over $100 per kilowatt of capacity demanded, whereas others with much more pretentious installations were yielding only about $30. The raising of the gross earnings per kilowatt of station capacity is one of the principal problems before the commercial men of the central-station business. If the service is good and the rates anywhere within reason, the connected load and peak load will grow rapidly from year to year. This does not necessarily mean, however, that for each kilowatt of station capacity installed greater revenue is being received. The real struggle comes in improving this condition by making each unit of capacity do more work. This compels the securing of some load which does not come on during the yearly peak period, or at least can be shut down during that period at the option of the company. In the smaller towns city water pumping and operation of refrigerating and ice-making machinery are the most common possibilities along this line. Electric irons and heating appliances also help to fill in the valleys of the load curve. It goes without saying that before power contracts of relative magnitude in a community can be secured, the rates must be such as to encourage power users who operate many hours per day. The only logical way to do this is to make a rate which becomes lower as the number of hours the consumer uses his installation per month increases, or else make a fixed readiness-to-serve charge plus a very low kw-hour charge.

LIMITATIONS OF THE GAS DECISION.

Since the United States Supreme Court decision in the Consolidated Gas Company case will probably stimulate legislation for regulation of rates, it is important to emphasize the cautionary statements of the court, which should limit the effect of its conclusions on vital questions to the city and corporation directly involved. These questions relate in part to franchise value and the rate of return on an investment. Concerning the sum allowed for franchises in the computation determining the value of the property, the court states that "what has been said regarding the value of the franchises in this case has been necessarily founded upon its own peculiar facts, and the decision thereon can form no precedent in regard to the valuation of franchises generally, where the facts are not similar to those in the case before us. We simply accept the sum named as the value under the circumstances stated." Preceding its conclusion that the corporation is "entitled to 6 per cent on the fair value of its property devoted to the public use," the Supreme Court says: "There is no particular rate of compensation which must in all cases and in all parts of the country be regarded as sufficient for capital invested in business enterprises. Such compensation must depend greatly upon circumstances and locality." Continuing, the court discusses the influence of the element of risk and states that there are other matters which may properly be taken into account in determining the rate which an investor might expect or to which he would be entitled without legislative interference. It is plain, however, that the court regards the Consolidated Gas Company as the possessor of a monopoly of the gas service in the largest city in America, a fact which in itself is applicable to no other company.

The Supreme Court decision is now a matter of history, but the demonstration of its inapplicability to every other public utility corporation whose rates become a subject of regulation or controversy will be a task that may try the minds of many representatives of corporate interests for several years. It is right, however, that the gravity of the task should be recognized and that public education upon the serious aspects of the situation should be undertaken. If more publicity had been given to corporate affairs in the past, the distress of the last few years would have been lessened; and now that publicity is a national policy, it would be unfortunate if companies did not prepare to present their points of view on all questions affecting the integrity of the investment and the cost of operation. No franchise definitely limited to a period of years fixed in advance was concerned in the case under consideration, and no conclusion was required, therefore, as to the necessity for provision for amortization if a company is to make proper provision for its shareholders and creditors before its rights of operation cease. If companies will accept limited franchises, they should do so with a full understanding on the part of their security-holders and the public served as to the rights, if any, which are to have recognition at the expiration of the term. In the fundamental respect that the franchise of the Consolidated Gas Company is not limited, this case is different from many that may be brought before the highest court eventually for final decision.

No fault can be found with the statement of principle applying to the rate of return on the investment, made by the court, that "the less risk, the less right to any unusual returns upon the investment." The element of risk necessarily exists in every investment, although to an inappreciable extent in the safest securities in this country, the bonds of the Government of the United States. From that security there are many grades of investment and speculation, with the interest return increasing, generally, as the risk becomes larger. What constitutes risk in investment is, however, difficult to determine in advance, even when good business judgment and knowledge of values direct the disposal of the funds and skilful management and undoubted integrity prevail in the corporation whose securities may be purchased. The urban railway, in its progress from horse to cable power and then to electricity, is an example of the revolutionary changes in types of equipment and the consequent destruction of property which time and service have effected in one class of public utilities. No one can predict with absolute assurance that the future will not develop a necessity for alterations equally radical in the equipment of other public utilities. From changes of this nature, adding, perhaps largely, to capitalization, the public receives better service; and the expenditures required to provide the improvements, whether large or small in extent, are met necessarily either by the issue of capital securities or through operating expenses. In either event, the cost should be considered as an element in the fixing of rates. Inseparable from the consideration of this aspect of the situation is the danger of loss from casualty, such as that experienced in San Francisco and Baltimore, which can never be predetermined, but which may never occur in serious degree. No fixed rule can guide all communities in their relations with public service corporations affecting the rate of return. The interest allowed should be fair to those whose capital is involved, and it should be large enough to attract new capital when needed for extensions. No single arbitrary rate can be applied successfully in all cases.

Practice of Massachusetts Commission on Questions of Capitalization.

Extracts from the report of the New York Public Service Commission, Second District, were published in a recent issue. This report discussed the questions of discounts on bonds, working capital and allowance for promotion services and the differences in the practice of the New York commission and that of the Massachusetts commission. An article from Boston states on this subject:

The Massachusetts laws place considerable discretion with the commission in these questions affecting issues of capital securities. A street railway or lighting company may increase its capital stock or issue bonds to such an amount as the Railroad Commission or the Gas & Electric Light Commission, respectively, shall determine will realize the amount which has been properly expended or will be properly required, and as the commission in either case shall approve for the purposes set forth by the company's petition.

The Gas & Electric Light Commission is understood to view these matters as follows:

Discount on bonds.—The commission requires bonds to be issued at par.

Working capital.—The commission permits an issue of stock or bonds to provide working capital in the original capitalization of a company.

Allowance for promotion services.—The commission has never approved promotion expenses and it is understood that the question of so doing has never come before the board.

A Public Utilities Commission for Vermont.

The agitation in Vermont for a public utilities commission has been given definite shape by the passage of an "Administration" bill, which has now been approved by the Governor. Two or three measures of the kind, more or less favored by the corporations, have been before the Legislature, but this one enlarging the powers of the railroad commission has been carried through because of the administrative support given to it.

The Board of Railroad Commissioners of the State is now to be known as the Public Service Commission, and in addition to the control of all railways it has been given "general supervision of all companies engaged in the manufacture, distribution and sale of gas or electricity for lighting or heating, of all express companies, and of all companies owning or operating telegraph or telephone lines, stations or exchanges * * * and shall have supervision of companies engaged in the manufacture, sale and distribution of power, so far as relates to their use or occupancy of the public highways and so far as relates to furnishing power for public use."

Under Section 9 the commission is given jurisdiction over the purity, quantity or quality of any product, including the measurement, pressure or initial voltage, as well as the provision of standard commercial units. It can also direct "the manner of operating and conducting any business * * * so as to be reasonable and expedient, and to promote the safety, convenience and accommodation of the public." Under the same section the commission has supervision over the price, toll, rate or rental charged. It can forbid any discrimination and can interpose to prevent overcapitalization in the issue of stocks, bonds or mortgages.

All rate schedules are to be filed and to be open to public inspection, and no changes are to be made except on 10 days' notice to the commission. If rates are found unfair, and if service is not adequate, the commission can order changes; but this does not imply that like conditions can be enforced in different parts of the State. All the companies are to keep their books, etc., open for inspection or production, but apparently this does not include any provision for a uniform system of accounts. Fines and penalties are set down for refusal or neglect, up to $5,000 for a final offence and not less than $500.

Any person or corporation aggrieved by municipal authorities as to grant of a license or location can appeal to the commission; and any company desiring right of way can secure it through the commission, after compensation is paid, which judgment is final except on appeal to the Supreme Court. Complaints as to any alleged unlawful corporate act, or otherwise, affecting any plant or line subject to this law can be taken up by the attorney-general or the State's attorney of the county or by 10 or more freeholders. All accidents resulting in loss of life or incapacity must be reported.

Section 23 is important in providing that "nothing in this act or previous statutes shall be construed as giving the Public Service Commission power to prevent or restrict competition or limit the number of persons or companies who may engage in the business of furnishing light, heat, power or any other business subject to supervision under the provisions of this act in any town." This clause is understood to owe its insertion to the independent telephone companies, but is not welcomed by any of the other public utilities, which believe that if supervised they should also be guarded against "strikes" and unbridled competition.

Petition for Rehearing of Consolidated Gas Company Case.

Counsel for the Consolidated Gas Company, of New York, filed a petition with the United States Supreme Court, at Washington, on Jan. 26 for a rehearing of the 80-cent gas case. The petition asks specifically for "a rehearing upon such points as the court may specially designate," or "if such rehearing be denied, a modification of the decree so as to make it conform to the conclusions reached by the court and to protect the rights of your petitioner."

The petition states that the decree is inconsistent with the conclusions of the court, saying: "The fundamental proposition of petitioner, that it could not furnish gas to the consumer (including pressure requirements) under the provisions prescribed by the 80-cent act, at the 80-cent rate, was sustained by this court, which, therefore, declared the pressure and penalty provisions to be unconstitutional; but the court has inadvertently failed to grant the petitioner any relief in these respects. * * * No precedent has been found in the decisions of this court, where a complainant has sustained a substantial portion of his bill, and yet has been denied all relief and the entire costs of the litigation have been imposed upon him."

Taking up another point, the petition says that "controlling facts were overlooked or misapprehended by the court. The court has found that petitioner is entitled to a return of 6 per cent upon the fair value of its property devoted to the public use. * * * This court accepted the net income, as found by the Circuit Court, as $3,024,492.14, representing less than 5½ per cent return on the said total valuation of $55,612,435. Upon that finding, therefore, the conclusion was inevitable that the act complained of was unconstitutional and void. The court, however, refrained from drawing that conclusion, because 'increased consumption at the lower rate might result in increased earnings, and the cost of furnishing the gas would not increase in proportion to the increased amount of gas furnished'; and because 'a slight reduction in the estimated value would give a 6 per cent return upon the total value of the property.'"

This point is discussed in detail in the petition, which says in part: "The court overlooked the fact that profits from an abnormal increase in sales had already been assumed and included by the Circuit Court. As the income of $3,024,000 found by the Circuit Court thus already includes an impossible increase in consumption due to the reduction of the rate to 80 cents, it is obvious that there can be no further increase from that cause. But even that unwarranted increase assumed by the Circuit Court falls far short of bringing the return up to a 6 per cent basis. For the income, at 6 per cent on the value of the tangible property ($47,831,435), plus the value of special franchises ($7,781,000), aggregating $55,612,435, would be $3,336,000; and the difference between that sum and the income found by the

Circuit Court ($3,024,000) is $312,000, to produce which would require the sale of an additional 1,040,000,000 ft., on the basis of 30 cents profit per 1000 ft. as found by that court (80 cents, less 50 cents to cover material, labor and return on manufacturing plant only), with no allowance whatever for distributing expenses. In other words, in order to bring the rate of return up to 6 per cent, there would have to be a total aggregate increase in sales for the year 1906 over those of 1905 of 2,176,000,000 ft., without allowing anything for increased distribution expense or for any return on increased distribution capital. Such an increase would be 20 times the increase in the sales of 1905 over those of 1904, and is quite inconceivable; and it far exceeds any increase in petitioner's experience due to increase in population and reduction in price combined.

"The court erroneously assumed that only a 'slight' reduction in the valuation of the tangible property would be necessary to produce a 6 per cent return.

"The second reason given by this court for declining to hold the rate confiscatory, namely, that a 'slight' reduction in the estimated value of the tangible property ($55,612,435) would yield a 6 per cent return, overlooks the fact that the reduction would not be 'slight.' The accepted income of $3,024,492.14 represents, at 6 per cent, a total valuation of only $50,409,867, or a reduction of the very large sum of $5,202,568.

"The only possible method available to your petitioner of proving the value of its tangible property was by expert evidence. This court has uniformly accepted the findings of the lower court where they were supported by the evidence."

It is asserted in the petition that an actual test of the 80-cent rate would involve inevitable confiscation. The petition says on this point:

"This court has uniformly held that a public service corporation complaining of a rate should not be required to make an actual test of the rate before bringing suit. If such a requirement should be imposed, then, in all cases where there is any conflict in the evidence and where the result is in doubt, it must necessarily follow that no one can successfully contest such a rate without submitting to the confiscation of a portion of his property, while the test is being made. In other words, irreparable injury is inevitable, unless the new rate is enjoined at the outset, security being furnished to the public by a bond or by deposit in court, as was done in the present instance.

"The order of the Circuit Court, requiring such a deposit, took effect on May 1, 1906, the date when the new rate became operative; and as 20 per cent of the receipts were, by the original order, required to be deposited in court, it is evident that the fund would now amount, on the basis of annual sales equal only to those of 1905, to more than $7,000,000. (As a matter of fact, the fund deposited does not exceed $5,000,000, because the Circuit Court did not require the deposit of the fund subsequent to the date of its final decree, being satisfied with the responsibility of your petitioner to return the excess since that date if its decree should be reversed). An actual test, at the 80-cent rate, could probably not be made satisfactorily on less than a year's experience, owing to the varying nature of petitioner's business, due to the changes of season. To compel your petitioner to wait until after a year's test had been made at the 80-cent rate would add at least $2,600,000 more to the sum involved in a final decision; and the trial and disposition of a new suit, commenced in January, 1910, might require two years further time during which the 80-cent rate would be in force, representing a further loss of at least $5,200,000. If, at the end of that period, your petitioner should demonstrate to the satisfaction of this court that the act did not permit a return of 6 per cent upon the reasonable value of its property, it would thus have been deprived of earnings to which it was legally entitled, amounting to the enormous aggregate of nearly $15,000,000, or nearly one-third of the entire value of all its tangible property as assumed by this court."

The petition then takes up recent decisions of the Supreme Court bearing on the subject of rates, and refers to the Knoxville water case as follows:

"The Knoxville water case, which has just been decided, was entirely different in its facts from the present case. The company there was dealing in an article which was not manufactured and for which there was no substitute, and the business was small and free from the complications which exist in the extensive business of your petitioner. No injunctive relief was apparently asked for, as the suit was not commenced until nearly a year after the new rate had been established; and there were no excessive penalties and no impossible pressure provisions, such as those complained of in the present case. Moreover, not only was the suit not commenced promptly, but no diligence was shown in its prosecution, as it was allowed to drag along for years, not reaching this court until 1908, although it was commenced in 1901. While the evidence of the actual business done by that company subsequent to the establishment of the rate was available, such evidence was excluded by the lower court, upon the objection of the complainant, and the proof was confined to the business done by the company for the year prior to the taking effect of the rate complained of. The case was thus entirely devoid of the conclusive evidence which was available, and the complainant deliberately threw away its opportunity to prove the alleged invalidity of the rate; and this court properly held that, having failed to give any competent proof when it had the full opportunity to do so, it was not entitled to any further indulgence."

The petition states that the Consolidated Gas "suit was commenced to enjoin the rate complained of on the very day it took effect; it was prosecuted with unexampled diligence, considering its magnitude, and the very best evidence available was produced.

"It was absolutely essential that the present suit should be commenced before making a practical test of the new rate, in order to obtain relief against the oppressive pressure and penalty provisions of the act, and to preserve the fund which was the subject of the controversy.

"The net earnings of petitioner for the year 1908, on a basis of 80-cent gas, after deducting all items of expense of the character disallowed by the Circuit Court for 1905, are at least $600,000 below the $3,024,000 estimated by the court for 1906 and show a return of only about 4 per cent upon the property valuation of $55,612,435 employed by this court, which does not include expenditures since 1905 of $1,442,897 for additional (chiefly distributing) plant. The result is a deficit in 1908 below earnings required to pay a 6 per cent return upon even $55,612,435, of about $1,000,000, representing at 6 per cent over $16,000,000 of assets which would receive no return under the 80-cent rate."

Single-Phase Equipment for the Spiez-Frutigen Railway.

The Berner Alpenbahn-Gesellschaft has decided on the electrification of the full-gage line from Spiez to Frutigen and has ordered three motor-cars and one locomotive for the service. The system will be the same as used on the Seebach-Wettingen line and is also similar to that to be used for the Wiesental Railway, an order for the electrical equipment of which has recently been placed by the State Railways of Baden.

The Spiez-Frutigen line will be worked by single-phase current at a frequency of 15 cycles per second and a line e.m.f. of 15,000 volts. Energy will be supplied by the Vereinigten Kander and Hagneckwerke, and for this purpose two additional 3200-hp generating sets will be installed in the power station at Spiez. Each set will consist of a turbine directly coupled to a single-phase generator designed for an e.m.f. of 16,000 volts.

The trolley wire will be supported by a catenary in the center of the track at a height of approximately 21 ft. above the rails, and the energy will be conveyed to the motor-cars and locomotives by means of bow collectors.

The motor-cars will be provided with two bogies. They will be about 65 ft. long and provide seating capacity for 64 passengers, third class.

The maximum gradient on the Spiez-Frutigen line is 1.55 per

cent, but the maximum gradient on the Loetschberg Railway, which forms the continuation of the former line, ranges up to 2.7 per cent. The motor-cars will, therefore, be designed for four single-phase motors having an aggregate output of 880 hp. As long, however, as electric operation is confined to the Spiez-Frutigen section only two motors will be provided. The weight of the fully equipped motor-car will be 55 tons, and the motors are sufficient to haul a train having a total weight of 160 tons up a gradient of 2.7 per cent at a speed of 28 miles per hour, or a train weighing 240 tons up a gradient of 1.5 per cent at the same speed.

The locomotive will have a total motor rating of 2000 hp and will be capable of hauling trains of 310 and 500 tons up the gradients of 2.7 and 1.55 per cent respectively, at a speed of 25 miles per hour.

Each of the two bogies is provided with a 1000-hp, single-phase motor which drives the three axles by means of gearing and coupling rods. These motors will be the largest single-phase commutator motors yet built. The whole weight of the locomotive—approximately 86 tons—will be utilized for adhesion. The motor-cars and locomotive will be equipped with transformers for reducing the line e.m.f. of 15,000 volts to the variable voltage required for the motors when running at different speeds. The maximum speed for the motor-cars and the locomotive has been fixed at 43½ miles per hour. The motor-cars are intended for regular service on the Spiez-Frutigen section, while the locomotives are primarily intended for experimental purposes looking to the adaptation of electric traction on the main line later.

The work in connection with the electrification is being directed by Consulting Engineer Herr Thormann, in Bern. The motor-cars, locomotive and the overhead equipment will be supplied by the Oerlikon and Siemens-Schuckert companies.

Employees as Stockholders in Spokane Trolleys.

The example set by the U. S. Steel Corporation and other companies in giving employees the opportunity to become stockholders is being followed on the Pacific Coast. Jay P. Graves, president of the Spokane & Inland Empire Electric Railroad Company, operating interurban lines in Washington and Idaho and power plants in and near Spokane, has addressed the following letter to the officers and employees of the entire system, setting forth a plan by which they may become stockholders:

"A number of corporations in the United States have during the last few years adopted plans whereby their employees were afforded opportunities for acquiring their stock or securities on safe and easy terms, believing that thereby employer and employee were brought closer together to their mutual benefit.

"Believing thoroughly in the principle, and desiring to bring about and maintain between this company and its employees a community of interest and consequent good feeling, the company has arranged with the Union Trust Company of Spokane to supply to any officer or employee of the company shares of its preferred rights or preferred stock at the going market price, plus an interest which may have accrued on the purchase price between the time of purchase by the trust company and its sale, and a commission of 5 per cent on the amount purchased. No profit is made by the trust company except the commission, it purchasing the stock in the market and selling it to the purchaser at cost.

"Easy terms will be made, the purchaser paying not less than 15 per cent of the purchase price in cash, and the deferred payments being arranged to suit the purchaser, provided that not longer than five years' time will be allowed, the deferred payments bearing interest at 5 per cent per annum.

"In case the purchaser becomes sick or disabled, leaves the service of the company, is discharged or dies before the stock is paid for, the Union Trust Company will, if requested to do so, cancel the contract and repay to the purchaser, or in case of death, to his heirs, all sums paid on account of the purchase price. After the purchase is completed the company will, in any of the events above stated, take the stock off the hands of the purchaser, or his heirs, at the price paid for same, plus 5 per cent per annum interest and less any dividends on the shares that may have been paid.

"The par value of the shares is $100, the selling price by the trust company to be the cost plus commission and interest. Holders are entitled to dividends at the rate of 5 per cent per annum before dividends are payable to holders of the common stock. Above 5 per cent, up to 7 per cent, the two stocks share equally in dividends. The shares are redeemable at any time by the company upon payment of $135 a share and accrued dividends. Owing to the recent financial depression it is believed that the shares can now be purchased for less than par."

Relation of Quasi-Public Corporations to the Public.

Mr. Henry L. Doherty in an address made at the special convention of the Indiana Electric Light Association at Indianapolis, Jan. 26, discussed the subject of the relations of public utility corporations to the public. For the past few years, he said, there has been in this country a movement against all corporations and against public utility corporations in particular. This, he thinks, has in some degree been the fault of the managers of these corporations themselves. These officers have felt that education of the public involved reaching so many people as to be very difficult, if not impossible. Therefore, they had generally waited until harmful measures were brought up before legislative bodies and then had brought forth their arguments. It was easier to present the company side of a case to a few in this way than to reach the mass of the people. If the presentation of the company's side of the case was not successful before legislative bodies and unjust legislation was passed, the officers had always felt that there were the courts to fall back upon and that justice could be obtained there even if nowhere else.

Attempts at public utility legislation had taken on different forms from year to year, and he reviewed these one by one. The first movement was to limit franchises to short terms. This plan proved to be more dangerous to public service companies than central-station men had at first thought. The expiration of a franchise was formerly looked upon by the majority of such companies as merely the time for the renewal and revision of the terms under which the company should continue to do business. However, as has been recently demonstrated in the Cleveland street railway franchise case, the company may in some cases be considered as having no rights on the streets whatever after the expiration of the franchise, and therefore it must figure on establishing a sinking fund which will return to the investors all that they have put into the property by the time the franchise expires. This feature in itself necessarily makes the cost of service to the consumer higher than it should be because of the large amount that must go into the sinking fund. For this reason it has become recognized by thinking men that the short-term franchise is not desirable, and that in some form or other franchises must be perpetual if the best and cheapest service for the public is to be obtained.

The second movement to regulate these companies was to tax their franchises. A third method that had been tried in many communities is that of allowing competing companies to come in. This idea of regulation of public services by competition is now generally looked upon unfavorably by thinking business men. It involves an economic waste in duplication of lines and apparatus, unnecessarily encumbers the streets and does not in practice give the results that have been expected of it where it has been tried. The fourth movement was to regulate the quality of service rendered. In this the thing most to be feared is unintelligent regulation, which makes the company conform to unnecessary and expensive requirements which bring no commensurate advantages to the consumer.

The fifth and most recent movement which he enumerated

was that of rate regulation. In defense of this kind of regulation it is sometimes argued that if a City Council in its ignorance establishes rates that are not fair to the company there can be a resort to the courts and the necessary relief obtained. In this connection it must be remembered, however, that credit is a very delicate thing and that the necessity for litigation alone may be enough to force a company into bankruptcy. Its case in court may be just, but the fact that it has to be in court at all tends to destroy or impair its credit. For this reason many companies are to-day saying that if State regulation by commission is to be intelligent regulation, by all means let us have it in preference to what we have had.

One of the principal points urged in favor of public utility rate regulation by some has been the prevention of stock watering thereby. The agitation about stock watering had been all out of proportion to the amount of real injury that has been worked to individuals by such practice. For example, the agitation about stock watering has been heard much more than that pertaining to our pure food laws, and yet the injury to individuals in the case of adulterated foods had been much greater than in the case of stock watering.

To sum up, we have 20 years of anti-corporation agitation to overcome. After all, public opinion is what we must reach. There is a common theory that the corporation does not have as high a moral standard as the individual. As a rule, he thinks the corporation is more honest than the individual. Its acts are necessarily more public and it has to be fairly honest to do business at all. It is commonly thought that the corporation is something primarily for the benefit of the men of large capital. The fundamental theory of corporations is to make it possible for men of small capital to conduct large enterprises.

Mr. Doherty defended overcapitalization as a perfectly legitimate operation. In the starting of a new enterprise where there is risk he considers it perfectly proper to capitalize the concern for the amount which it would be worth if fully developed to the extent expected by the promoters. He could not understand why an investor in a public utility company should be denied the profits which investors taking similar risks in other kinds of enterprises are allowed without question. For example, he cited the case of two Western men who went into a small Western town in its early days. A put his money into building a street railway. B put his money into real estate. A had to nurse his investment along constantly from year to year. All the risks of a small street railway in a new town were his and it took constant attention to its operation to pull it through. B did not have to watch his investment. He could leave it whenever he pleased. The street railway which A had built was at work constantly increasing the value of B's land. Others were building around B's property and making it more valuable. At the end of 20 years all property in the city had increased enormously in value. It is now contended that A is not entitled to a profit on his investment above current rates of interest, and he is in general looked on as a robber for expecting more. On the other hand, his real-estate friend who has realized great profits out of the efforts of others is looked upon with approbation by all and no one questions his right to his profit.

If public utilities are to be extended to the smaller communities the public must not only deal fairly, but liberally with the companies. The public, on the other hand, is entitled to three things: First, complete service from a geographical standpoint, so that the territory is covered; second, good service; third, low rates.

Two States, New York and Wisconsin, are trying the experiment with regulation by public service commissions, but they have been established such a short time that their workings can be considered as yet experimental. Mr. Doherty commended very highly the work being done by the Wisconsin commission, and said that it is at present composed of high-grade men with competent corps of experts. He expressed the opinion that regulation by commission will be the solution of some of our present problems. To accomplish the desired purposes, however, the commission must have powers not held by any other body, and powers therefore resting with other bodies must be revoked.

As regards the present situation in Indiana, where public utility commission laws are likely to be presented to the Legislature this session, he advised delay until the results of the trials of the plan in Wisconsin and New York could be seen and the experience of these States profited by. The companies with which he is connected have purchased from time to time many electric lighting properties in different States, but are not at present investing in any such properties in States where there are commissions. They want to see how the commission idea works and what chance there is for profit under such a form of government. He expressed the opinion that the passage of a commission law in Indiana at this time might possibly have the effect of preventing the investment of the necessary capital in much-needed extensions and improvements of central-station properties for a time. In view of the large amount of capital from outside the State needed for this purpose during the next two years, he advised letting things remain as they are for the present.

Following Mr. Doherty's address, Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, said he did not oppose the idea of having a suitable commission. He was not sure, however, that we have had enough experience with State commissions to draft a suitable bill which will be the best for all concerned. The Indiana Manufacturers' Association had appointed a committee to draw up a bill for presentation to the Legislature. This committee had heard all interests involved and he had no doubt that when they got through that whatever bill they might recommend it would be a fair one.

Development of Public Utilities Under the Wisconsin Law.

A reference was made in the issue of Jan. 28 to the address of Professor B. H. Meyer, chairman of the Railroad Commission of Wisconsin, before the Northwestern Electrical Association on the subject "Future Development Under the Wisconsin Utilities Law." The commission of which Professor Meyer is chairman has jurisdiction over the public utilities of the State.

Professor Meyer said in his address that the success of the law would have to be measured by the quality of the service rendered by the utilities, the price charged for the service and the development of the business which provides the service. No provision of the law is more important that the section which provides for profit-sharing and sliding-scale arrangements. In expressing his firm conviction that "the sliding-scale arrangement is full of promise for the future," and that in it is found "the solution of one of the most important factors, if not the most important factor, affecting the development of utility enterprise in Wisconsin," Professor Meyer said:

"The profit-sharing provisions go chiefly to the scale of wages to be paid by the utility, while the sliding-scale provisions go primarily to the rate of return upon the investment as the reciprocal of the rate of charge paid by the consumer.

"When the individual promoter or manager or investor feels that with greater and keener application, with increased efficiency and economy, the rate of return upon his investment will be increased, he is much more likely to aim toward efficiency and economy than he would if no such inducements were held out to him. Under a sliding-scale arrangement the hope of greater profit combines the interest of producer and consumer. Leaving out of consideration other factors, it may be said that the consumer desires service at the lowest possible price and the utility desires to furnish this service at the highest possible rate of profit. The nucleus of the sliding-scale idea is to permit a utility to earn a higher rate of profit in proportion as the price charged by it to the consumer is lessened.

"For illustration, we may assume an electric-light plant which is at present charging 16 cents per kw-hour. We will assume, further, that this is a fair and reasonable rate under the conditions under which the plant operates to-day. As time goes on this plant, due to efficiency and enterprise in management, extends the list of its consumers, it thoroughly saturates the territory

which it serves, it introduces greater economy, it employs more efficient men, and as a result of all these and other improvements it is put into a position to furnish light at 14 cents per kw-hour. If, while the price was at 16 cents, it was earning only 4 per cent on the investment, it is quite possible that with the improvements indicated and the growth of its business it may now be making 6 per cent when the price to the consumer is only 14 cents. We will still further assume that this same progress in production and management continues until the plant can furnish current at 10 cents per kw-hour, and that then its rate of profit is 8 per cent on the investment. It is apparent that if the management of a plant of this kind operating to-day under the conditions specified can have before it constantly the incentive of an increase in the rate of profit in proportion as the price to the consumers goes down, no efforts will be spared to bring about this reduction in the price to the consumer in order that a higher rate may be secured for the investor.

"As a second illustration we may consider a plant which is now charging, say, 12 cents per kw-hour, and which is earning 6 per cent on its investment. If the management knows that with every cent or fraction of a cent of reduction in the price the rate of permissible profits will go up, it is extremely probable that the best which science and ingenuity, diligence and persistence can accomplish will be done in order to earn this higher rate of profit under a sliding-scale arrangement.

"A third and still different case may be assumed, namely, that of a plant which has been poorly managed, which represents an investment far in excess of what would be reasonably necessary under normal conditions, and which in consequence has been earning only a very low rate of return, say, 2 per cent. If, under a sliding-scale arrangement, the management of this plant is told that if it will organize its labor force more efficiently, if it will employ more skilful engineers, exercise greater economy and use more intelligent effort in extending its business, it will be allowed to earn as high as 8 or 10 or 12 per cent, it is quite probable that a marked change in the management of this business will occur. If the investor once realizes that his failure to earn a higher rate of return is due to wasteful methods, incompetency and similar avoidable causes, he will turn to the management of the plant and demand improvements along these lines in order that this higher rate of return may be achieved. The present abnormally low rate of return is, under the conditions assumed, merely an index of inefficiency, extravagance or wastefulness. From no point of view would it be justifiable, under the assumed state of facts, to demand of the public that it pay a rate for the service sufficiently high to yield the legal rate of interest on the investment.

"It is probable that sliding-scale arrangements of this kind must be brought about entirely through the voluntary and cooperative efforts of utilities. It is doubtful whether the commission can entirely on its own initiative prescribe and enforce them. The law says: 'Nothing in this act shall be taken to prohibit a public utility from entering into any reasonable arrangement with its customers or consumers or with its employees for the division or distribution of its surplus profits, or providing for a sliding scale of charges, or other financial device that may be practicable and advantageous to the parties interested." * * *

"The sliding scale arrangement will prevent lapse and stagnation and tend to keep in places of greatest responsibility the most competent men, the adoption of the best known and most approved methods, and the installation of the best types of machinery and appliances.

"While the utilities law fully protects the investor in his claim to a reasonable return, this provision of the law, it appears to me, intends to equally insure the wage earner his fair share in the profits. A plant which can meet the highest technical requirements, which can earn a high rate of return, and still charge a low price to the consumer must necessarily employ the best of men, which generally means also that it must pay the best wages. A profit-sharing scheme by which premiums are paid to all the men employed in a given plant is likely to work for efficiency and economy, as the higher rate of return on the investment which the manager sees for himself and his stockholders in the achievement of the same ends. In other words, the sliding-scale and the profit-sharing schemes combine the interests of the investor with those of the consumer and of the wage earner connected with the utility plant.

"The law provides that all such arrangements shall be subjected to the supervision of the commission; and it is needless to add that if sliding scales or profit-sharing schemes should be adopted which are on their face unfair to any one or more of the parties in interest, such schemes would be promptly ordered to be modified. An arrangement under which, for instance, nearly all the increased net earnings resulting from greater economy and efficiency and progress were to go to the investor without a corresponding reduction in the price to the consumer, should not be permitted to stand because of the obvious inequalities and inequity involved. Similarly, if the management of the plant were to enter into an agreement with its employees that an unduly large part of the whole of the increased net earnings were to be paid in the form of a bonus to labor, such arrangement should be set aside with equal promptness, and the consumer given his fair share of the surplus in the form of a reduced rate.

"The time will soon come, if it is not already here, for the commission to call a general conference of representatives of utilities for the purpose of discussing the sliding scale and profit sharing in their relation to the consumer, wage earner, investor and the development of the business. A statement of the history of these things would afford a starting point for the deliberations of the conference, and Wisconsin experience would give the discussion direction and shape."

Professor Meyer then discussed, as closely allied with these arrangements, the introduction of new methods, machinery, appliances and fixtures. He said on this subject:

"Progress depends very largely upon these, and whatever the interpretation of the law may be in any particular respect, this interpretation should always and inevitably spell progress.

"In very recent times there has been a marked development of water power in the State of Wisconsin. This development has scarcely begun. No one can foretell what the future has in store for us along those lines. It seems reasonably certain that many different communities will soon have offered to them electric current generated by water power many miles away. We will assume the communities to which such offers are made have in operation within their borders electric light and power plants operating under an indeterminate franchise. Under the public utilities law neither the municipality nor a private company can construct and operate a competing plant without first securing from the commission a certificate of public convenience and necessity. What is the duty of the existing utility and of the commission to the public under this assumed state of facts?

"To keep out the cheaper current generated by water power would be to compel people within the limits of that municipality to pay much more for current than it would be possible to purchase it from the water-power producer knocking at the city gates. To prevent the newcomer from entering the municipal limits without any restrictions or conditions would, in most cases, probably result in the annihilation of the existing plant. In the one case the whole consuming public would be compelled to pay much more than is necessary, and in the other the investment in the existing plant would be practically destroyed. Neither of these extremes is necessary nor desirable.

"If the management of the existing plant realizes its duty toward the public, and if the newcomer likewise realizes that its new opportunities and privileges are associated with equally certain duties, the two parties will get together upon a fair and equitable basis by which the existing plant will be utilized to the fullest extent possible consistent with the full utilization of the cheaper current brought in from without. Voluntary action upon a fair basis by which investors in the existing enterprise and consumers receive equal and fair consideration appears to be the solution. If it should come to a question of hold-up on the part of one party or the other, it appears to me inevitable that the commission will be compelled to issue a certificate of public

convenience and necessity, which under the assumed state of facts will mean ruinous warfare and all the losses and wounds attendant upon this method of conflict."

Professor Meyer then referred to a suggestion made by the manager of an electric plant in a small community, saying: "In a proceeding before the commission he stated that it was the desire of his company to reach the greatest possible number of consumers at the lowest possible price with the smallest possible investment on the part of the company, and that with this end in view his company was urging consumers to purchase high-efficiency lamps of a small candle-power. He stated it as his desire that consumers in that community use 4-, 8-, 10- and 12-cp lamps, thereby enabling the poorest people to enjoy the benefits of electric light at an expense easily within the capacity of their family budget.

"This suggests one of the most promising lines of development. I believe that the philosophy underlying the action of this manager of a small plant in a community composed chiefly of people of small means is exactly right. He is apparently actuated by the praiseworthy motive of spreading the use of electricity among the widest possible circles at a price which will enable even the poorest to enjoy its advantages and at the same time afford the company a reasonable return upon its investment."

Professor Meyer said he regretted "in the light of all the provisions of the utilities law, and from the viewpoint of good service and of reasonable rates, that not all the utilities have surrendered their franchises and taken in lieu thereof an indeterminate permit.

"If there is one thing above all others which the history of the utility business has established, it is that competition as a guarantor of good service and a regulator of rates has failed. The verification of this simple truth has cost the people of this and other commonwealths untold millions of dollars. The spirit of the utilities law is that wasteful competition and useless duplication of plants shall cease. It is conceivable that public convenience and necessity may in certain cases, due to obstinacy, bad management or other causes, require the construction of a competing plant, but such cases should be very rare, indeed, or, better still, they should never be permitted to occur. It would be nothing less than an economic crime to attempt to reopen the door to competition in the utility business with a mistaken notion that through such action the public will secure better service at lower rates.

"I must confess that personally it was a matter of disappointment to me that relatively so few utility plants availed themselves of the opportunity to surrender their respective charters on or before July 1, 1908. The commission has recommended the extension of time during which charters can be surrendered and I hope that in the event that the Legislature should see fit to amend the law in this respect every utility plant in the State which has not already done so will surrender its franchise."

The question of the relation of the value of the property of utility plants devoted to public use for rate-making purposes, as compared with the value of the same plants for purposes of taxation was discussed by Professor Meyer. "I am free to admit," he said, "that the identity of what for the sake of brevity I shall designate as the 'tax value,' on the one hand, and the 'rate value,' on the other is an ideal condition toward which we should move with the greatest possible speed. I hope the time will come in Wisconsin when the value placed upon a utility plant for rate-making purposes will be exactly the value upon which it is taxed, and vice versa. It is impossible of accomplishment to-day. To make the two values identical to-day would be a gross injustice and inequality in many, if not in most, cases.

"As I understand it, the taxing authorities endeavor to see to it that all property is made to stand upon a footing of equality in the payment of taxes. The constitutional requirements of equality apply to all dollars irrespective of their owners, and a dollar in a utility plant should bear the same burden that is borne by a dollar in a farm or city, lot or factory and all other forms of property, ignoring for the present controversial questions which publicists in taxation have raised regarding the doctrine of equality. This means that the tax value is a commercial value. Commercial value depends primarily upon earning capacity. A utility plant is worth what it can earn. What it can earn and does earn is dependent upon the rate which it charges. To use the earning value of a plant as a basis for determining the rate which creates that value is to attempt to measure a thing by itself. Commercial value, and therefore tax value, being a mere reflex of the rate, can be no guide whatsoever in determining the reasonableness of a rate. As long as the tax value is the commercial value under existing conditions, it is obvious that such tax value cannot be the value for rates, or at least that it is not necessarily the value for rates. It follows that any discrepancy under these conditions between tax value and rate value is not necessarily injustice. In fact, justice may require just this discrepancy. If the taxing authorities, because of their inability to ascertain the exact commercial value of all forms of property, should, for instance, assess farms or city property at 80 per cent of their respective values, the property of public utility plants should stand upon the assessment roll at 80 per cent of their value. Because of the publicity and other features attendant upon the conduct of the utility business, it is generally true that the value of utility property can be more readily ascertained and more generally known than the value of numerous other forms of private property. To assess a utility property at 100 cents on the dollar and industrial or farming property, at 70 or 80 cents on the dollar would be unjust and unlawful. A commission charged with the duty of prescribing just and reasonable rates could, therefore, not take the tax value as a basis for determining rates.

"In the case last assumed the tax value was only 80 per cent of the commercial value, and if we assume further that this commercial value is identical with the investment, it follows that the rates must be based upon the 100 per cent and not upon the 80 per cent value. It may also occur that the rate value is very much less than the tax value. This would be true in all those cases of assessment at full commercial value where this value is the result of unusually high rates of return on the investment, due to extraordinarily high rates of charge. In a word, under present conditions, the rate value may be identical with the tax value, it may be lower or it may be higher than this value, and all in accord with principles of exact justice and equality.

"It might be still further assumed that for the present year, for instance, a company pays taxes upon $500,000, while the commission in determining its rates figures upon a return of only $400,000. Nor is there any injustice in a situation of this kind as such. It is assumed, of course, in this illustration, that the commission has fixed $400,000 as the fair value of the property used and useful for the convenience of the public. The rates prescribed insure the company a reasonable rate of return upon this $400,000 in addition to its operating expenses and depreciation. The taxes which this assumed company pays are paid upon $500,000, because during the past year that company charged a rate of return which made its property worth $500,000 as a commercial proposition. The taxes which it pays are paid for a period of time during which it earned this high rate, namely, during the past year before the commission had reduced its rates. One year from now the situation in our hypothetical case will have changed and then it would be the height of injustice to compel the company to pay taxes on a valuation of $500,000. We are assuming $400,000 as the true investment value. If the taxing authorities are assessing all property at 100 per cent of its full value, then for the next year this plant should pay taxes on $400,000. If other property is assessed at only 75 per cent of its value, then this plant should pay taxes on $300,000. In cases of this kind the tax value is a value which trails after the rate value, it being readjusted to successive reductions in the rate. I am assuming, further, in this illustration that there will be no transgression of the constitutional limitations of confiscation in the establishment of the rate and that, furthermore, a sliding scale is in effect."

The Latest American Telephone Statistics.

Below is given a preliminary report from the Bureau of the Census for the telephone industry for the continental United States, exclusive of Alaska, Hawaii, Philippine Islands and Porto Rico.

The statistics relate to the years ending Dec. 31, 1907, and 1902.

In these totals are included reports of all commercial and mutual systems and farmer or rural lines, but excluding reports of telephone lines operated by steam and electric railways, nor do they include reports of isolated systems operated exclusively for the benefit of commercial and manufacturing enterprises, federal, state and municipal governments.

	1907.	1902.	Per cent of increase.
Number of systems and lines*	22,971	9,136	151.4
Miles of single wire	12,999,369	4,900,451	165.3
Number of stations or telephones, total.	6,118,578	2,371,044	158.1
Bell (American T. & T. Company)	†3,132,063	1,317,178	137.8
Independent (non-Bell)	2,986,515	1,053,866	183.4
Number of public exchanges	15,527	10,361	49.9
Number of switchboards, total	16,065	10,896	47.4
Common battery system	2,146	837	156.4
Magneto system	13,801	10,005	37.9
Automatic	118	54	118.5
Estimated messages or talks during year, total	11,372,605,063	5,070,554,553	124.3
Local exchange messages	11,119,867,172	4,949,849,709	124.7
Long distance and toll messages	252,737,891	120,704,844	109.4
Total income‡	$184,461,747	$86,825,536	112.5
Total expenses (including taxes, interest and fixed charges)	$140,802,305	$65,164,771	116.1
Total cost of construction and equipment (including real estate and telephones)	$819,667,008	$389,278,232	110.6
Capitalization:			
Capital stock authorized, par value	$1,121,931,023	$384,534,066	191.8
Capital stock outstanding, par value	$512,685,265	$274,049,697	87.1
Dividends on stock	$23,733,670	$14,982,719	58.4
Bonds authorized, par value	$556,537,932	$158,099,094	252.0
Bonds outstanding, par value	$301,930,739	$73,981,361	308.1
Interest on bonds	$12,316,109	$3,511,948	250.7
Total par value stock and bonds outstanding	$814,616,004	$348,031,058	134.1
Employees and wages:			
Salaried employees, number	25,298	14,124	79.1
Salaries	$19,298,423	$9,885,886	95.2
Wage-earners, average number	118,871	64,628	83.9
Wages	$48,980,704	$26,369,735	85.7

*The statistics of farmer or rural lines included in this report are confined to number of lines, miles of wire and number of telephones: 1907, 17,702 lines, 486,294 miles of wire, 565,649 telephones; 1902, 4,985 lines, 49,965 miles of wire, 55,747 telephones. It is probable that a more thorough canvass was made of these lines in 1907 than in 1902, which accounts in part for the large increase.

†Exclusive of 85,287 farmer or rural stations receiving exchange service through switchboards of "Bell" companies. A large proportion of these stations were reported as and included in total stations for independent (non-Bell) systems.

‡Includes assessments of mutual systems.

The final report for 1907 will contain an analysis of the above totals and present detail statistics for other phases of the industry.

In this connection it is of interest to work out the averages derivable from the above data, and below are submitted some of the most important figures of that nature:

	1907.	1902.
Average miles of wire per system and lines	565.9	536.4
Average miles of wire per system (exclusive of rural lines)	2,375.0	1,168.5
Average miles of wire per station, total	2.1	2.1
Bell	2.9	2.6
Independent	1.4	1.4
Number of exchanges per system (exclusive of rural lines)	2.9	2.5
Messages or talks per station per year	1,859	2,139
Messages or talks per station per day (325 days)	5.7	6.6
Long distance and toll messages, per cent of total	2.2	2.4
Income per station	$30.15	$36 62
Expenses per station	$23.01	$27.48
Per cent of expenses to income	76.3	75.0
Average cost of construction and equipment per mile of wire	$63.05	$79.44
Average cost of construction and equipment per station	$134.00	$164.22
Outstanding stock and bonds per station	$133.14	$146.78
Average rate of dividends on stock outstanding	4.6	5.5
Average rate of interest on bonds outstanding	4.1	4.7
Average yearly salaries of salaried employees	$763.00	$700.00
Average yearly wages of wage-earners	$412.00	$408.00
Average miles of wire per farmer or rural line	27.5	10.0
Average stations per farmer or rural line	32	11
Average miles of wire per farmer or rural stations	.86	.90

Naturally, some of the "averages" are to be accepted with caution, but it is to be noted that the income per station is much less than five years ago, that expenses per station are less, cost of plant is less, and average capitalization is less. This is all obviously due to the creation of so many rural lines. The Bell system is still predominant.

A Gas View of High-Efficiency Electric Lamps.

The program of the annual meeting of the Indiana Gas Association, held last week in Indianapolis, is typical of the programs of gas associations in that all the papers related specifically to problems of management and operation. The following titles of the papers read at the meeting illustrate this characteristic: Commercialism in the Gas Business; High-Pressure Boosting; Handling of Complaints; Distribution Methods; Gas Chemistry; High Candle-Power Illuminants; Handling and Collecting Delinquent Accounts; The Marketing of Coke Locally; Meters and Meter Reading. All the papers were submitted by employees of gas companies with one exception. This latter is a paper by Mr. J. Earl King, of the Welsbach Company, of Chicago, on "High Candle-Power Illuminants—Gas vs. Electricity," of which an abstract is given below.

The object of the paper, Mr. King stated, was to outline the competition of electric companies through the recent introduction of high candle-power lamps for interior illumination. Before turning attention to these lamps he referred briefly to the flaming arc, which, though an out-door illuminant, is sometimes employed in interior illumination. This lamp, he said, probably produces the highest candle-power of any single unit known, but is not suitable for ordinary interior lighting on account of the peculiar quality of the light, its harmful effect upon the eye and obnoxious odors. Its rated candle-power is 1500. The cost of operation is about 5 cents per hour, figuring current at 10 cents per kw-hour. The indoor flaming arc is a form of competition which has given gas men more or less to think about, but has been met successfully by the upright gas arc and various types of upright gas clusters and single gas lamps, the difference in cost and value of illumination having been so largely in favor of gas installations.

The candle-power of the 4½-amp, 500-watt, indoor electric arc is rated at 500, but the actual candle-power is nearer 400. The cost of operating this lamp per hour is 5 cents (current at 10 cents per kw-hour). A four-mantle upright gas has a nominal candle-power of 400 and for a large unit has been the standard of gas illumination for about four years. The cost of operating this type of gas arc is about 2 cents per hour (gas at $1 per thousand).

After referring briefly to the Nernst and tantalum lamps, the tungsten lamp is taken up. This lamp, producing one candle for each 1¼ watt of current consumed and having a life rated at 800 hours, has, Mr. King stated, given the electric companies an opportunity to advance the idea that electricity, as consumed through a tungsten lamp, is as economical as gas for lighting. This theory has been advanced during the past summer months, which have been exceptionally warm, by the electric companies and its representatives, and a great many consumers have been secured who believed they were going to obtain electric light of a superior quality at the price of gas light. The electric companies, he said, generally use many technical terms not fully understood by customers and this has resulted in many instances in a confusion in the mind of the latter with reference to the service and the cost of service he was to receive, owing to which many gas users have been influenced into changing to electric service. As the electric bills for the longer lighting periods are being rendered, some dissatisfaction is being expressed by these former gas users. The actual comparisons are as follows:

For comparative purposes, we selected the four-light, 60-watt tungsten cluster, which is the most popular form of installation. The fixture most generally used is one containing four lamps and equipped with a 20-in. porcelain reflector. This is the fixture that has given the tungsten lamp its reputation in Chicago. The fact that the lamps are of higher candle-power than the old carbon filament generally used, and that the light is of such quality as to confuse and deceive the sense of sight, has made it generally believed that the tungsten is a great light producer. The same lamps equipped with Holophane distribut-

ing reflectors give us a unit of entirely different appearance and one which for comparative purposes, using the naked eye, is more suitable.

To successfully compete with the tungsten cluster a new inverted gas cluster fixture has been placed on the market. This consists of two, three or four inverted gas lamps arranged on a scientifically designed pendant fixture and is operated by a chain pull which gives it all of the convenience of electricity. While in appearance it is equally as attractive as the tungsten cluster equipped with Holophane reflectors it is much more pleasing in appearance than that type when equipped with a 20-in. porcelain reflector. As a light producer, the inverted gas cluster fixture has never been equaled. The gas consumed in a four-light inverted gas cluster is 13 1/3 cu. ft. per hour. Practical tests have proved the above figures correct. The cost of operating the four-light inverted gas cluster for one hour is 1 1/3 cents with gas at $1 a thousand.

While it is true great improvements in electric lighting have been made, it is also true great strides have been made in incandescent gas lighting and to-day the gas man is just as far ahead of the electric man in the lighting proposition as he was when the comparison was made between the gas arc and the electric arc, or between the single upright mantle lights and the carbon-filament lamps. It is obvious that to underestimate the strength of a competitor is a serious error. It is also obvious that to overestimate this strength shows poor judgment.

The competition to gas lighting offered by the tungsten lamp has caused much uneasiness, and many a gas manager has seen that serious inroads might possibly be made upon his illuminating output if he were obliged to compete with the new electric proposition along the old lines. In fact, the electric companies have, in some localities, secured a considerable increase in output at the expense of the output of the gas companies. The electric cry being increased light at less cost, and the gas companies with the old lighting systems having nothing new to offer their customers either in style or fixture or increased efficiency or illumination, it has not been particularly hard to convince a consumer to change over to electricity. A new lighting device always finds a following. If it is of special merit it soon has a large patronage, and almost any gas-lighting system favored and prompted by a gas company will be taken up readily by the public, the public's experience being that the gas company wishes to give the most light for the least cost.

As the electric proposition is new it naturally follows that unless something new is offered in competition, it will secure a considerable following which it would not be able to obtain if the gas lighting offered in its stead is of the up-to-date order and gives increased illumination at a decreased cost. Gas men realizing this, have always adopted new devices of merit even if the new appliance reduced the output of their product temporarily.

Dr. Steinmetz Lectures in Boston.

Dr. Charles Proteus Steinmetz, of Schenectady, N. Y., gave a lecture on "The Future of Electricity" before the Society of Arts of the Massachusetts Institute of Technology, in Boston, on the evening of Jan. 28. A large audience was present. Dr. Steinmetz pointed out that within two centuries the coal supply of the country would be exhausted, and emphasized the probable dependence of future generations upon water powers now being wasted. These will be electrically utilized for heat, light and power, and for fertilizing the soil, which is already showing signs of exhaustion. Dr. Steinmetz pointed out that there are only a few rivers in the world which naturally overflow their banks, as does the Nile, and said that, although Nature does her best, she is being subjected to constantly greater burdens. He urged that water power is the only natural source of energy required to operate mills, factories, transportation systems and central stations, and through the agency of electricity alone can the nitrates now being wasted be collected and distributed upon the fields and prairies to give forth the vegetation by fertilization that is needed. Electricity has accomplished great things in bringing the cities and country into closer touch, but it will be needed far more in the future.

Meeting of Ithaca A. I. E. E. Section.

The regular meeting of the Ithaca Section of the American Institute of Electrical Engineers was held on Jan. 25, at which Mr. M. M. Goldberg, a graduate student in the university and an alumnus of the University of Munich, read a paper on "Variable Speed Induction Motors." This paper was based partly upon the convention paper of Mr. H. C. Specht, on "Induction Motors for Multispeed Service, with Particular Reference to Cascade Operation." Mr. Goldberg outlined clearly the principles of induction motor operation, giving a simple mathematical treatment of the induction motor based upon the rotating field. By this means he showed what would be necessary to change the speed of such a motor, explaining why an increase of secondary resistance is not a practical means of reducing speed. He then outlined the various methods used for obtaining several speeds from the same motor, pointing out the objections to each. An animated discussion followed the paper. In the course of this Prof. V. Karapetoff gave a clear exposition of the application of the circular diagram to induction motors operated in cascade. From the circular diagram Prof. Karapetoff was led to differ from some of Mr. Specht's conclusions. He also enlarged upon the use of the synchronous motor, rotary converter and Heyland motor in combination with the induction motor, for the production of variable speed at high power factor. The paper and discussion brought out numerous questions, the answers to which were of interest. The meeting was one of the best from the technical standpoint that has been recently held by the local section. It illustrated an important principle in the conducting of university branch meetings, namely, that a preliminary discussion of the general subject should prepare the way for a more specific study of engineering practice.

Indiana Electric Light Convention.

The Indiana Electric Light Association, which was organized Nov. 24 of last year, held a special meeting at the Claypool Hotel, Indianapolis, on Jan. 26. The attendance was most gratifying, about 75 central-station men being present. It, therefore, appears that Indiana at last has a successful central-station organization. Only one session was held, lasting from 1:50 to 5 p. m. The meeting was presided over by President T. C. McReynolds, of Kokomo. The secretary announced that the association started with 49 charter members. Ten new applicants were then voted in, making the total membership 59.

President McReynolds in his address reviewed the advantages of such an organization and pointed out how necessary it was for electric light men to get together in view of the rapid changes which are continually taking place as regards equipment and business methods. He announced that for this special meeting only two subjects would be considered, tungsten lamps and public utility commissions, both being very live subjects at the present time. As to the tungsten lamp, he thought that it brings an opportunity never before presented to invade the field of cheap illuminants. As to the proposed public utility commission which is being talked of in the Legislature, now in session at Indianapolis, he took no decided stand, but he urged members to consider very carefully whether it would be better for themselves and their communities to have public utilities regulated by a State commission or by various local governing bodies as now. Probably in some towns the relations between companies and public are so harmonious that no one would wish to change. In other places it might be an advantage. The Indiana Manufacturers' Association is drawing up a commission bill for presentation to the Legislature and at the time such a bill was urged in the association it was urged on the grounds that it was necessary to protect the public from stock watering. As a mat-

ter of fact, it was needed much more, he said, to protect the companies from unjust and ill-advised local legislation by those who do not understand the business.

An address was then given by Mr. Henry L. Doherty, of New York, on the "Relation of Quasi-Public Corporations to the Public." This was discussed at length by Mr. C. C. Perry, president of the Indianapolis Light & Heat Company, and a number of others. An abstract of this address and discussion is given elsewhere.

A paper on "Tungsten Lamps" was read by Mr. R. M. Cass, of the Indianapolis Light & Heat Company, which drew out considerable discussion on the methods of introducing tungsten lamps in different towns. Discussion on this will be given in a later issue. The meeting adjourned to hold its regular convention in August.

Thomson-Houston Reunion.

A reunion of the men formerly associated with the Thomson-Houston Electric Company was held at Chicago Thursday, Jan. 28. While the attendance was not as large as was anticipated, the enthusiasm shown by those who were present more than made up for the depleted representation of the "old gang." A reunion of Thomson-Houston employees was first suggested last May at the annual meeting of the National Electric Light Association, when many of the old Thomson-Houston men were in evidence. The suggestion met with hearty approval, and Mr. George Cutter, of South Bend, Ind., took charge of the direction of affairs for the reunion, and his efforts were rewarded by the attendance at the reunion of 30 of the men formerly employed by the Lynn (Mass.) Company. Many of those in attendance are now very well known in the electrical field. During the day the men met at the Coliseum, where the fourth annual Electrical Show was being held. In the evening a banquet was given at the Great Northern Hotel, after which an experience meeting was held.

Judge Cummins, of Chicago, was called upon to act as toastmaster. He is familiar with the biography of many of those present and made many interesting allusions to the past in his introductory address. Mr. Bernard E. Sunny, president of the Chicago Telephone Company, told some interesting occurrences of the days when he was associated with the Thomson-Houston Company. He said he thought the success of the old company was not alone due to the excellence of its electrical apparatus, but also to a great extent to the energy of the representatives of the company. In closing his talk, Mr. Sunny paid a tribute to Mr. C. A. Coffin, and referred briefly to the development in the manufacture of electrical apparatus.

Mr. Bion J. Arnold told of his experience in the early days when he went to Chicago determined to get into the employ of the Thomson-Houston Company. He applied for a position to Mr. Sunny, and after making many efforts was finally given employment. He had his first lesson in selling dynamos at the Chicago stockyards, and was later sent to Lake Geneva to make a sale of electric apparatus, and finally went to St. Louis, where his company was having some trouble in supplying current on a 2-0 trolley wire for the operation of 40 street cars. Mr. C. A. S. Howlett made a few allusions to the early days, and called attention to the evolution of the electrical industry as is shown by the fact that the Chicago Electric Club now has a membership of more than 450 members, mostly engaged in the commercial side of that industry. Mr. Ernest Gonzenbach said he was one of the early members of the $5.90 per week brigade at Lynn. He recalled the date of manufacture of the first 200-kw generator, which was then considered a high engineering achievement. He urged that the Thomson-Houston reunion be made a national affair and that steps be taken to make it a permanent organization. Mr. George Cutter said he went with the Thomson-Houston people in 1883, and since then has followed the interesting development of the electrical business. He urged that another reunion be held at the annual meeting of the National Electric Light Association this summer, and said he would select a committee to make arrangements for the holding of the second reunion. Several other old Thomson-Houston men gave pleasing reminiscences of the early days of the company. Letters of regret at being unable to attend were read from Professor Thomson, Messrs. E. W. Rice, James W. Johnson and William Upman.

Meeting of Boston A. I. E. E. Section.

The regular meeting of the Boston Section of the American Institute of Electrical Engineers was held at the Edison Building, Boston, on Jan. 20, Chairman Kennelly presiding. The subject discussed was "Some Electrical Operating Features of the Boston Elevated Railway Company's System," the speaker being Mr. John W. Corning, electrical engineer of the company. Before the address the chairman introduced Mr. Ralph W. Pope, of New York, secretary of the institute, who spoke of the growth of the organization and gave an account of the Engineering Societies Building in New York.

Mr. Corning described the growth of the Boston system since the consolidation of companies and electrical equipment of the lines, which took place about 20 years ago. These lines were supplied from a power plant at Allston having a capacity of about 900 kw and equipped with Edison bipolar generators belted to high-speed engines. As routes were extended and horse-car lines electrified, additional stations were built until at the present time the company has 10 power plants of its own, with a total capacity of about 52,563 kw, and is buying power at three other points. The sizes of the present stations are as follows: Central, 12,900 kw; central auxiliary, belted, 800 kw; Lincoln, 13,500 kw; Charlestown, 7000 kw; Dorchester, 3600 kw; Harvard, 6300 kw; East Cambridge, 2800 kw; Medford, 975 kw; Allston, 888 kw; Somerville, 700 kw; East Boston, 600 kw; purchased power, 2500 kw.

The stations are operated in multiple through the feeder system and sections, of which latter there are 75, of which 68 are surface feeder sections and the balance for the elevated division. Of 75 feeder sections 38 are fed by two or more stations, and it is through these tie sections that the company is able to work in multiple and secure an equalization of load at times of low steam pressure, etc., resulting in loss of capacity. The load of the system has a characteristic curve through the 24 hours, with a morning peak between 8 and 9 o'clock and an afternoon peak between 5 and 6 due to a wave of traffic radiating in all directions from Boston to the suburbs. The peak on the different stations, therefore, does not occur at the same time. There is nearly an hour of difference between the peak on the Lincoln power station and the peak on the Hyde Park station of the Old Colony Street Railway Company, which furnishes about 200 kw to the Boston Elevated. In this way the stations that are tied together through the sections of the feeder system can help each other out, because at the time the peak load occurs at the outlying stations it is receding from the stations nearer the center of the city.

Of the different sections of feeders on the surface lines the lightest section in point of average load during the peak hour is one of about 60 amp. That section is on a street seldom traversed by surface cars, but on which there is a considerable traffic by the company's own service cars. The maximum section has an average demand during the peak hour of 2400 amp. On the elevated section the maximum is about 4000 amp. In order to carry this total load the company has 441 miles of trolley wire, about 500 miles of overhead feeder, about 200 miles of underground feeder and about 17 miles of third rail on the elevated division. The cars vary in length from 20 ft. to 46 ft., the typical cars and weights being as follows, without passengers:

Length, feet	20	25	26	32.5	33.3	44.6
Weight, tons	9	12	15	24	28	33

The average demands on the power stations are 18 kw for the 20-ft. car, 22 kw for the 25-ft. car, 26 kw for the 26.5-ft. car; for the lighter type of semi-convertible, 42 kw; for the heavier type, 56 kw, and for the elevated car about 65 kw. The equipment on the ordinary 25-ft. cars of the closed type con-

sists of two motors with series-parallel control; on the semi-convertibles, the Sprague G. E. multiple-unit and Westinghouse multiple-unit, although these cars are not run in trains. On the elevated cars the Sprague G. E. multiple-unit control is used. An elevated train of six cars will take about 2500 amp in full multiple. The company uses many interpole motors. These, besides the usual main poles, have four interpoles, the windings of which are arranged in series with the armature and are reversed with the armature to neutralize the demagnetizing effect of the armature current and improve the commutation.

About two years ago the company came to realize that its cars were not making as smooth accelerations as desirable, and an investigation was made into the arrangement of the resistances in connection with the controllers. It was found by taking automatic curves of the acceleration that the current throughout the series portion of the acceleration would be rather low and in the multiple portion extremely high, tending to creep up considerably beyond the maximum commutating ability of the motor. The result was that, as this heavy peak was encountered during every acceleration, the commutator became roughened until the motor began to flash and buck, with resulting service interruptions and high cost of maintenance. The different equipments were studied with an automatic ammeter and the resistance steps readjusted, so that in most instances a much smoother curve of acceleration was obtained. The net results were beneficial in all directions. In one case a certain type of car was being brought in every two or three days for commutator turning and brush cleaning, but after the resistance steps were changed the cars would often run months without coming in for such a purpose.

Mr. Corning then described the circuits and operation of the electric track switch. In the earlier types of track switch the company was troubled with frequent burnouts when cars became stalled on the overhead pan of the switch apparatus. In that case there was a steady current flowing which burned out some of the insulation through a resulting short circuit. The manufacturing company overcame the difficulty by inserting in the circuit an additional coil working with a plunger in a sort of dash pot, so that if a car became stalled the current in this coil gradually brought about a movement of the plunger and operation of contacts that broke the circuit of the apparatus.

The feeder system of the Washington Street tunnel was then taken up by the speaker. The third rail in the tunnel on the north-bound side constitutes one feeder section and that on the south-bound track another. In case of trouble with one section the traffic may then be continued on the other. This rail on both tracks is divided into sections corresponding to the signal block, so that power may be cut off from any one of these sections in case of trouble. The sections are arranged so that they may be connected all the way through by jumper switches, and each section has a supply from a feeder paralleling the third rail in the conduits alongside the track. If the distribution cable which feeds that rail becomes disabled from a burnout, the cable may be disconnected, the jumper switches at the ends of the sections closed in and the rail made continuous, feeding the trains while the regular feeder is out of service. There is a ventilating equipment in the tunnel consisting of four fan chambers, in which there are two fans each. The fans are each designed for 25,000 cu. ft. of air per minute, and the fans are operated by 6.5-hp motors. These fan motors have therefore been provided with automatic motor-starters so connected that upon the failure of the power the rheostat arm of the starter will fall back to the initial point ready for the resumption of power. If the power is interrupted and restored in a shorter space of time than it takes the arm to fall down to the initial position the motor does not start, due to an interlocking connection. It is impossible to catch the motor with the resistance all cut out when the motor is at rest. There are two of these equipments in each fan chamber, and besides the regular feed source for these fans there is an additional source so connected that upon the failure of the first source the second source of supply is automatically cut in, and upon the return of the first source the second is cut off. The first source of current for the tunnel fans is the third rail and the second is from a wire which comes in from a feeder section outside the tunnel, so that any interruption of the power in the tunnel itself will not affect the fans. There are three pump chambers equipped in the same way, and the lighting service is similarly equipped, with also an arrangement for automatic formation with the Edison Electric Illuminating Company.

Pittsburgh Section, A. I. E. E.

The regular monthly meeting of the Pittsburgh section, A. I. E. E., was held in the Carnegie Institute on Jan. 12, being preceded by a very enjoyable little social dinner held at the University Club.

The subject of the evening was presented by Mr. William Hoopes, of the Aluminum Company of America, in an original paper entitled "Electric Furnaces," and was illustrated by means of lantern slides. The iron and steel companies and kindred interests were well represented by prominent members, who took a great interest in the paper. The discussion was participated in by Prof. Fred. Crabtree, of the Carnegie Technical Schools; Mr. W. S. Hadaway, of the Westinghouse Electric & Manufacturing Company; Mr. H. W. Fisher, of the Standard Underground Cable Company; Mr. Ernest H. Brown, of the Arizona-Idaho Copper Extraction Company; Mr. E. C. Edwards, of the Firth Sterling Steel Company, and Mr. H. W. Muller, of the Allegheny County Light Company.

CURRENT NEWS AND NOTES.

REGULATION OF UTILITIES IN MONTANA.—A bill has been introduced in the Montana Legislature empowering the corporate authorities of any city in that State to regulate rates and charges for water, gas and electricity to residents.

LIGHTING OF AMERICAN STREETS.—The next meeting of the New York Electrical Society will be held in the United Engineering Societies Building, 33 West Thirty-ninth Street, at which Dr. Louis Bell will lecture on the subject "Lighting of American Streets."

A. I. E. E. MEETING.—At the meeting of the American Institute of Electrical Engineers to be held in New York on Feb. 17, Dr. C. P. Steinmetz will present a paper entitled "Prime Movers." It will discuss economic features and operating characteristics of all available types of prime movers.

COMPULSORY MARINE WIRELESS.—A third bill has been introduced into Congress providing that any ship carrying passengers from or to ports in the United States, or between them, shall have a wireless outfit if any stage in the ship's itinerary is 100 miles or more. The French government is also considering a measure to require all French ship owners to install wireless on vessels above a certain tonnage.

NEW YORK INDEPENDENT TELEPHONE ORGANIZATION.—At a meeting held in Rochester, N. Y., Jan. 28, the New York State Independent Telephone Conference Committee was formed with the following officers: President, Mr. George R. Fuller, Rochester; secretary, Mr. Max Eaton, Niagara Falls; treasurer, Mr. W. Roy McCanne, Rochester. One of the first acts of the association was to provide for toll coupon books for the western part of the State.

TEXAS STATE-AIDED TROLLEY LINES.—A bill before the Texas Legislature provides for submitting to vote an amendment to the constitution whereby counties may vote the levying of taxes and issue of bonds to build or aid in the building of interurban electric railways. It is stated that the construction of several such lines will be undertaken immediately upon the adoption of such an amendment, as people in the counties through which the proposed lines are to pass are willing to aid the several enterprises.

WEST AUSTRALIA UNIVERSITY.—It is proposed to establish a university in West Australia patterned after Cornell University.

C. Q. D.—Following is the significance of the initials which the newspapers have recently made well known in connection with the recent wreck of the *Republic:* C (ome) Q (uick) D (anger).

ENGINEERING ENGLISH.—A book recently issued with the title "The Changing Values of English Speech," written by Dr. Ralcy Husted Bell, charges that technical and engineering societies are "unconscious corruptors of speech."

RADIUM INSTITUTE.—The Royal British Radium Institute is to be established by charter under the auspices of King Edward, and in virtue of a large fund donated for the purpose by Sir Ernest Cassel and Lord Iveagh. The Council will include Sir J. J. Thomson and Sir William Ramsey.

PENNSYLVANIA TIE-TREATING PLANT.—The Pennsylvania Railroad Company has arranged to erect at Mt. Union, Pa., a preservative plant capable of treating from 1500 to 2000 ties per 24-hour day. The plant will be equipped for any process of recognized value, but it will operate mainly with creosote and zinc-chloride.

TUNGSTEN PATENT FRAUD CASE.—Henry E. Everding has been sentenced to two years in penitentiary for participation in fraud incident to the issue of a tungsten lamp patent to John A. Heany, of York, Pa. As previously noted, Barton, ex-Patent Office examiner, received a sentence of three years on similar charges. The court acquitted the inventor.

INSTITUTE BILLS INTRODUCED.—A bill has been introduced, appropriating $10,000 for the Worcester Polytechnic Institute, in accordance with the Acts of 1905, and in like manner, according to the Acts of 1896 and Resolves of 1901, a bill appropriating $29,000 has been introduced in behalf of the Massachusetts Institute of Technology.

SUIT TO COMPEL USE OF TELEPHONES.—The Merchants' Association, of Raleigh, N. C., has instituted proceedings before the North Carolina Corporation Commission to compel the Southern Express Company to install the telephones of the Raleigh Telephone Company in its offices. The merchants claim that it is to their interest to have this system in use by the express company.

SONS OF JOVE.—On Wednesday evening, Jan. 27, the Sons of Jove held a "Rejuvenation" at the Coliseum Annex, Chicago. It was largely attended. Twelve members were added, the work of initiation being done in costume. The membership of the order has now reached approximately 2000. After the initiation ceremonies, a light supper was served, at which Mr. Frank Perry acted as toastmaster, and 30 men gave two-minute talks. The Electrical Show afforded the opportunity for the Rejuvenation, which was carefully worked up and a great success.

FEDERAL WATER-POWER SUIT. — Attorney-General Bonaparte has authorized the United States district attorney at San Francisco, Cal., to bring suit against the Truckee River General Electric Company and the California-Nevada Electric Power Company and other parties interested to acquire possession of a certain tract of land at the outlet of Lake Tahoe, which is claimed to be necessary to the Truckee-Carson project of the United States Reclamation Service. The government has, it is stated, been negotiating for the property for the past six years, but has been unable to reach an agreement.

LEGAL STATUS OF TELEPHONE MESSAGES.—Recently a court in this country has held that a notice by telephone demanding payment of a note is a legal demand, and in another case it was held that a conversation over a telephone is, if corroborated by a third party who "listened in," legal evidence in an action. On the other hand, an English judge has decided that he "would hesitate long before he held that a man was necessarily bound by words that came over a telephone. Every contract made in that way ought to be confirmed in writing, if it were liable to doubt, before it was upheld by a court of law."

GOVERNMENT 3000-MILE WIRELESS STATION.—On Jan. 28 bids were opened in Washington for the long-distance wireless plant previously noted in these columns. The Telefunken Wireless Telegraph Company, of Philadelphia, offered to construct and equip the Washington station for $168,850. The National Electric Signaling Company, of Pittsburgh, proposed to build the tower for $108,900 and to build and equip it for $182,600. The bids of the Marconi Wireless Telegraph Company ranged from $249,295 to $361,094. The Massie Wireless Telegraph Company, of Providence, proposed to build and equip the wireless station for $300,000. The Radio-Telephone Company, of New York, bid only on the construction of the tower, which they offered to build for $52,950. Four bids submitted by the Stone Telephone & Telegraph Company, of Boston, ranged from $130,000 to $275,000.

FENDER TESTS.—Mr. A. W. McLimont, as electrical engineer of the Commission, has submitted to the Public Service Commission of New York a report showing the result of the street-car fender tests conducted at Schenectady and Pittsburgh and recommending that all cars throughout Greater New York be equipped with automatic wheel guards, and that in the Boroughs of Queens, Richmond and the Bronx and in a large section of Brooklyn the cars should be equipped with projecting fenders also. The cost of holding the tests was about $8,000, 1800 tests having been made. Thirty-eight fenders and 29 wheel guards were tested. No particular fender or wheel guard showed such efficacy as to warrant its preference over all the others, but the tests showed that many are far superior to those now in use and are less expensive to maintain. It is estimated that the cost of equipping the surface cars of Greater New York with the best type of life-saving devices will not exceed $300,000, while the companies operating such cars incurred expenditures for injuries, damages and legal expenses in the year 1906-07 amounting to more than $3,500,000, much of which could have been saved by proper fenders and wheel guards.

MUNICIPAL SOCIALISM.—It is announced from London that the organ of those opposed to the present paternalistic tendencies in British governmental and municipal affairs has just made its appearance. It is called the *Anti-Socialist.* Among the contributors are Lord Avebury, Yves Guyot, Sir Arthur Clay and Canon Hensley Henson. Lord Avebury thus summarizes the objections to Socialism: "It has been clearly shown that governments and municipalities cannot give the same care, thought and attention to details as private firms or companies. Services and products must be more expensive and the nation's output will be less. Wages, however, in the long run, are governed and determined by international competition. Government and municipal cotton mills and ironworks could not raise their wages or they would ruin their markets. Moreover, as governments and municipalities would not increase their works or adopt improvements so rapidly as private firms, the companies' demand for labor would be less, with the same, therefore, or probably lower, wages. The workingmen would have to pay a higher price for the necessaries of life. But this is not all. At present working men are free. They can choose employer and employment. Under the new system this would not be possible. The result to the working classes will be less employment, lower wages, dearer necessaries of life, and, direst misfortune of all, the loss to a great extent of the personal freedom they now enjoy."

Electric Motors in a Brewery.

By WILLIAM KEILY.

IN breweries, both large and small, there are numerous opportunities for the economical application of electric motors. But in a brewing establishment of the first rank, where the brewing of the beer is simply the largest of a number of manufacturing and shop processes connected with the business, it is astonishing to note the varied and often ingenious applications of electricity generated in a central plant and transmitted to the various points of application. The great plant of the Pabst Brewing Company, in Milwaukee, for instance, covers several city blocks, and is one of the show-places of the city. It offers an ideal opportunity for industrial power transmission by electricity, and it is something of a surprise to learn that the electric power plant is only now, in these opening weeks of the new year, barely finished. Electric lighting has been employed for some years, of course.

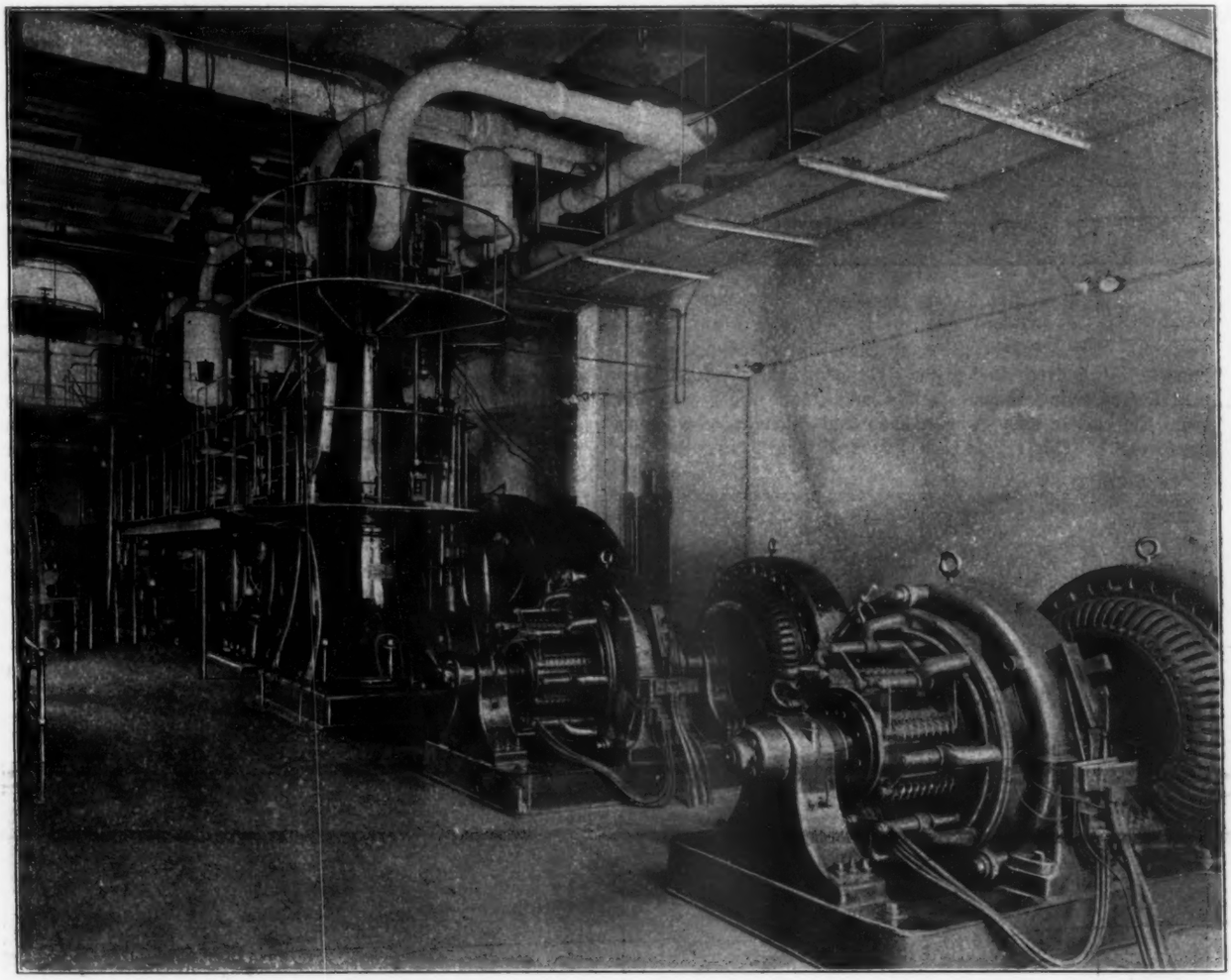


FIG. 1.—GENERAL VIEW OF THE ENGINE ROOM OF THE PABST BREWERY POWER PLANT.

Before the installation of the electric motors there were several steam plants in the extensive works, with lines of steam piping, in some cases 500 ft. long, and with various forms of mechanical transmission. Some of the belt and other transmission systems in use displayed great ingenuity in odd situations; but the whole combination was very uneconomical compared with one central power plant and electrical transmission. In one case an engine was employed to drive an important deep-well pump. Three men, in eight-hour shifts, were constantly employed to run this one engine, which was supplied with steam through a pipe several hundred feet long. This whole outfit was supplanted by the 50-hp vertical motor illustrated in Fig. 6. Now all the attention required is from the oiler, who, in making his rounds, examines the motor twice a day to see that the oil cups are full. The saving effected by this one change can be imagined. Applications of motor drive in the new Pabst Brewery power plant cover almost every form of connection, for there is a great variety of machinery driven, including machine tools, wood-working tools, galvanizing plant, deep-well pumps, air compressors, centrifugal pumping machinery, milling machinery, malt-house machinery, grain-elevator machinery, etc.

Steam is produced in a boiler plant house in a building 121 ft. long x 50 ft. wide. This building is of fireproof construction throughout, the exterior conforming to the general architectural design of the group of buildings. It contains six Munoz water-tube boilers, but ultimately it will be extended and two more boilers added. Each boiler is provided with 4011 sq. ft. of heating surface and is rated at 401 hp. The boilers are set singly and without brickwork, but are encased in a steel shell lined with tile and asbestos. Each is equipped with a Murphy automatic smokeless furnace. The products of combustion are conducted through a breeching constructed of steel casing lined with asbestos, fire-felt sheets, coated on the inside with Vitrox retort cement, into a brick chimney 225 ft. high and with a flue 11 ft. 6 in. in diameter. Installed in the breeching are Green fuel economizers, and all boiler-feed water, before passing through the economizers, is treated by the Sorge-Cochrane system, the apparatus being

installed on an elevated floor immediately in front of the chimney. Beneath this floor are the boiler-feed pumps.

Coal and ashes are handled by a Link-belt bucket conveyor system. By this means the coal is deposited in bunkers, from which, through scale hoppers, it is delivered to the mechanical

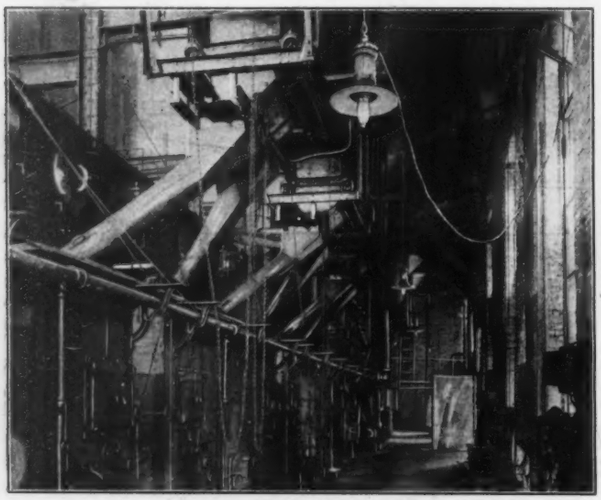


FIG. 2.—BOILER ROOM.

furnaces. Similarly, the ashes are lifted and deposited in ash hoppers for delivery to wagons. Hoppers have been provided also for receiving shavings, chips and small pieces of wood from the cooper shop, wagon shop and other wood-working departments. This refuse fuel is spouted directly into the fur-

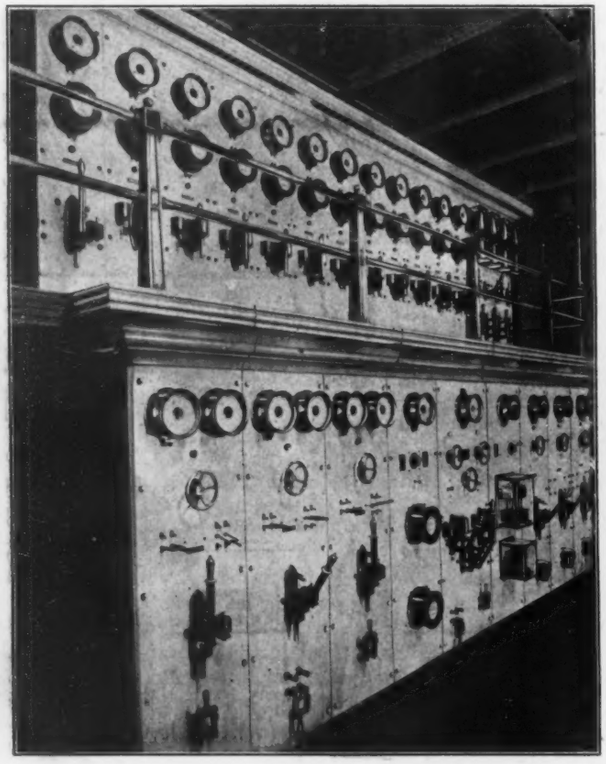


FIG. 3.—SWITCHBOARD IN POWER PLANT.

naces through special openings provided in the furnace construction.

The steam pressure carried in the boilers is 160 lb., necessitating the installation of a high-pressure piping system. The main header is placed beneath the breeching and at the rear of the boilers. It is divided into two sections connected by expansion loops around the chimney. From the boiler house the steam is conducted to the main engine room, 130 ft. away, through steam headers leading from each end of the main steam header. One of these connecting headers passes through

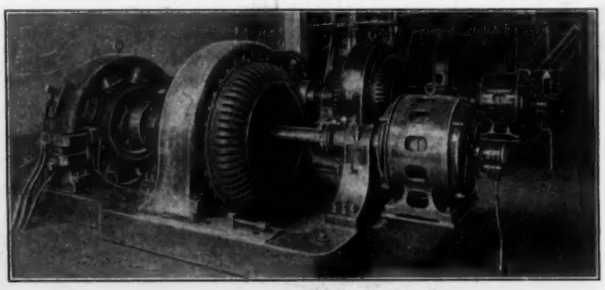


FIG. 4.—MOTOR-GENERATOR LIGHTING SETS, WITH STARTING MOTORS IN ENGINE ROOM.

a tunnel, the other is conducted overhead through the intervening buildings. The distance between boiler and engine rooms is explained by the fact that while the boiler plant is new, the generating units of the new electric installation are placed in the old engine room, which also contains all of the refrigerating machinery.

There are four generating units. Two of these are vertical engines direct-connected to 400-kw alternators. The engines are cross-compound and operate non-condensing. They drive, at 125 r.p.m., 440-volt, 25-cycle, three-phase, revolving-field generators. A third unit consists of a vertical, single-cylinder, non-condensing engine direct-connected to a 300-kw alternator of the type described, while the fourth embraces a Buckeye vertical, simple, automatic engine direct-connected to a 100-kw, 125-volt, direct-current generator. The total rating of the four units is 1200 kw. In addition there are two 125-kw, 125-volt, 500-r.p.m., direct-current generators, each mounted on a common base with and directly connected to a synchronous motor which drives it, and each having an induction motor with wire-wound secondary direct-coupled to the generator shaft for starting purposes. In Fig. 1 a view in the engine room, these motor-generator sets, used to supply energy for lighting, are shown prominently in the foreground. All engines, except the Buckeye engine, and all generators and elec-

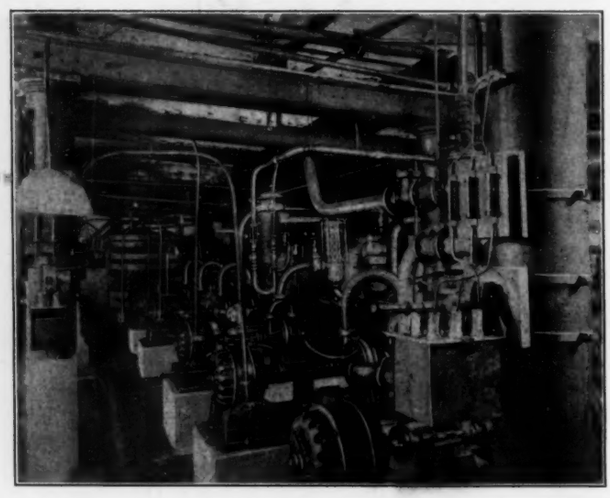


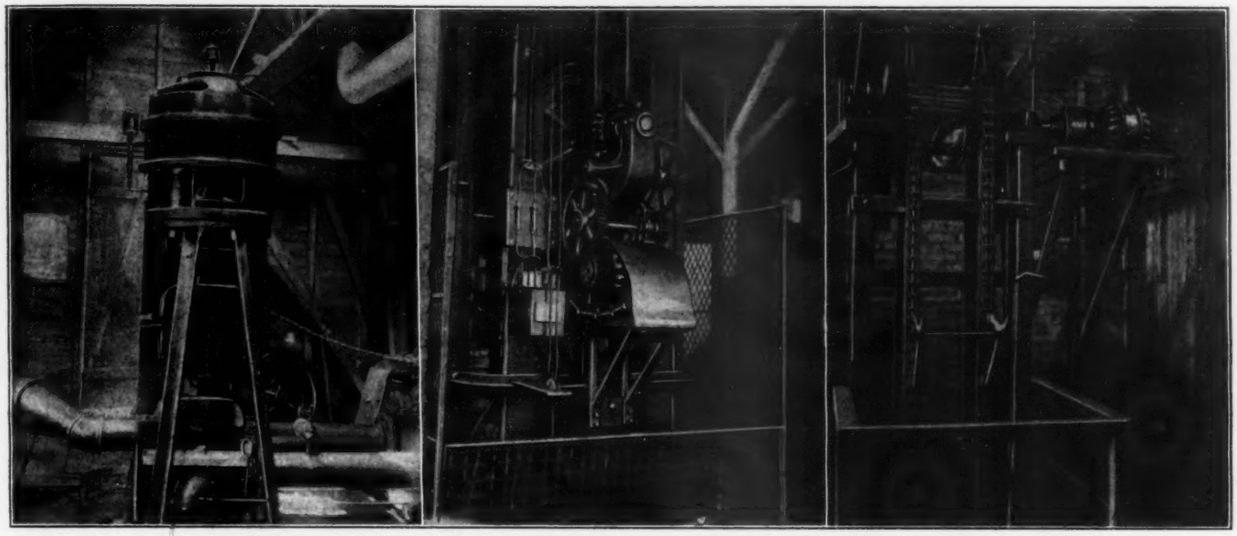
FIG. 5.—DIRECT-CONNECTED CENTRIFUGAL BRONZE BEER PUMPS IN PUMP CELLAR.

trical apparatus in the engine room were made by the Allis-Chalmers Company.

The connections for supplying steam to the engines consist of a main header, attached at each end to pipes leading from

the boiler room. From this header service pipes lead to the units. The exhaust from all high-pressure cylinders is delivered into one common receiver connection or header, from which steam at a pressure varying from 35 lb. to 42 lb. is delivered to various parts of the brewery plant, where it is used for brew-house and other purposes, as well as to the low-pressure cylinders of the compound engines.

That the varying demands for steam by the various departments may be met, arrangement has been made on both high-pressure and low-pressure cylinders of the compound engines for altering at will the ratio of steam consumption and the transfer of the load from one side to the other of the cross-compound units. Heavy demands for steam at from 35 lb. to 42 lb. pressure are met by extending the point of cut-off on the high-pressure cylinder and shortening the point of cut-off on the low-pressure cylinder, thereby transferring the greater part of the load on the unit to the high-pressure cylinder. Reduced demand for steam from the various departments is met by a reversal of the proceeding described. All exhaust steam from the low-pressure cylinders of the engines is consumed in the heating of water for general brewery purposes, the warming of the various departments when necessary, or in the drying coils in various departments.



FIGS. 6, 7 AND 8.—INDUCTION MOTORS DRIVING DEEP-WELL PUMP, BOX ELEVATOR AND BARREL ELEVATOR.

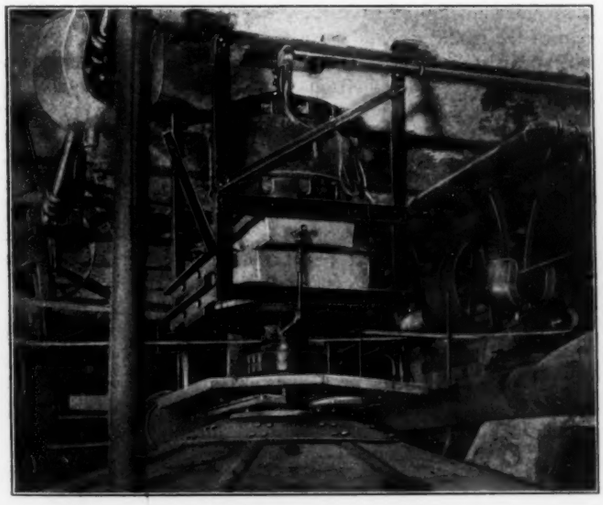


FIG. 9.—INDIVIDUAL MASH-TUB DRIVE.

The three-phase, 25-cycle alternating current is transmitted to the various departments. George F. Rohn, of Milwaukee, installed the transmission system. The control of all generating units, as well as of all feeders, is centralized in the main switchboard, which is constructed of English-vein white Italian marble, having a main board for the control of the generators and a balcony board above it for the feeder service. All circuits are controlled by automatic, overload, no-voltage release, oil-type General Electric switches. The equipment of instruments on the switchboard is very complete, indicating wattmeters, as well as watt-hour meters, being used in a manner to permit of obtaining an accurate record of the power generated or the energy consumed by each unit in the engine room and each department of the plant. The instruments are all of Westinghouse make, except the direct-current watt-hour meters, which are of the General Electric pattern. Kohler Brothers, of Chicago, built the switchboard.

Direct current at 125 volts, supplied by the synchronous motor-driven generator and the engine-driven direct-current generator, is used for lighting the entire premises. These direct-current machines also supply the exciting current for the alternators. The system of lighting used was adopted primarily to avoid the necessity of altering the existing illuminating system, to which many arc lamps are connected, and also to secure the condenser effect of the synchronous motors. Control of the induction starting motors on the synchronous motor-generator sets is accomplished from the switchboard by the use of rheostats.

FIG. 10.—INDUCTION MOTOR, SHAFT-DRIVEN, KEG-WASHING AND RINSING MACHINES.

Indicating lamps with bull's-eyes' have been provided on all generator and feeder circuits, so connected as to direct the at-

tention of the attendants in case of the opening of an automatic switch. All feeder circuits are installed underground and incased in iron-armored conduit mounted in tunnels. Distributing centers have steel cabinets with slate panels, and all fuses are of the enclosed type.

A count of the electric motors connected with the new power plant in this big brewery shows that there are no less than 151

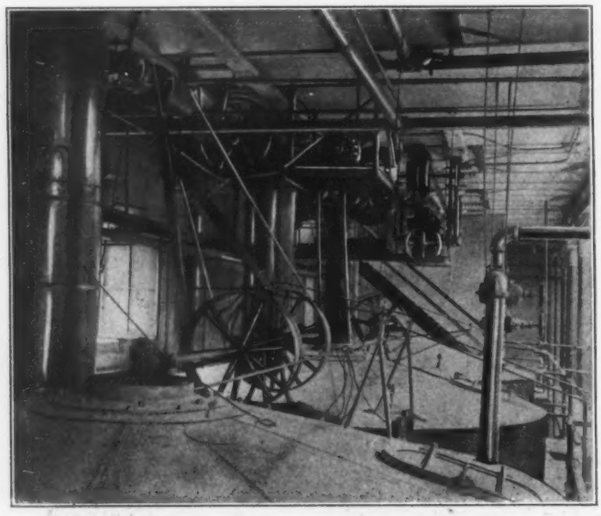


FIG. 11.—MOTOR-DRIVEN AGITATORS ON BEER TANKS.

of them, varying in size from ½ to 100 hp. In all they aggregate about 2600 hp. They are distributed among the various departments and are put to the most diverse uses, only a few of which can be referred to here. Induction motors are used exclusively, with one exception in the case of the motor-generators. Reference has been made already to the 50-hp vertical induction motor mounted on a deep-well pump, as shown in Fig. 6. The motor runs at 750 r.p.m. and is coupled through an O'Kelley speed-reducing coupling to the pump, which is of the Byron Jackson make. The speed reduction is in the ratio

FIG. 12.—BARREL ELEVATOR, SHOWING APPLICATION OF SPEED-REDUCING DEVICE.

of 1½ to 1. There are four additional equipments of this type except that the motors are rated at 40 hp.

Fig. 8 shows a 1-hp, 1500-revolution motor direct-coupled through an O'Kelley speed-reducing coupling having a ratio of speed of 44 to 1 to a shaft of a barrel elevator, and Fig. 7 shows a 1-hp motor mounted directly on and geared to what was formerly a belt-driven box elevator. There are several drives of this kind. A 15-hp, 750-r.p.m. vertical motor is mounted above and direct-coupled to the driving shaft of a mash tub through an O'Kelley speed-reducing coupling having a ratio of speeds of 50 to 1. This interesting combination is illustrated by Fig. 9. There are six equipments of this type. Another illustration (Fig. 12) shows a motor mounted upon a wall bracket, driving, through a speed-reducing coupling, a barrel elevator. The ratio of speed reduction in the coupling is 3 to 1, and there is a pulley mounted on a shaft extension with belt transmission to the shaft of the barrel elevator. The total reduction in speed is from 1400 to 110 r.p.m. This unusual arrangement was devised to meet existing conditions in the driving machine. This is the case with several other motor applications, and much ingenuity has been shown by the engineers in meeting difficult power requirements.

Fig. 5 is a view in the pump cellar. Here are installed a number of direct-connected, specially-designed two-stage and three-stage centrifugal beer-pumping units. The motors all operate at a synchronous speed of 1500 r.p.m., the capacities of the pumps varying from 52 gal. to 186 gal. per minute against static heads varying from 60 ft. to 120 ft. An interesting fact is that these pumps are entirely of bronze, as iron or steel would have an unfavorable effect on the beer.

Other applications with noiseless chain drives, direct-connection or single-reduction gears are numerous throughout the various departments. All freight and passenger elevators are operated by motors equipped with wire-wound rotors and are controlled by Westinghouse cable-operated elevator controllers. All motor equipments were furnished by the Westinghouse Electric & Manufacturing Company.

As a whole the plant is not only of unusual size for an industrial installation, but it is exceptionally interesting and instructive, with many ingenious "wrinkles." It does credit to Mr. C. A. Chapman, of Chicago, the consulting engineer, who designed it.

Comparative Tests of Transformers.

By A. C. Scott.

In view of the recent developments in the manufacture of sheet iron which have made possible lower core loss in transformers, it is presumed that comparative data and tests of commercial transformers as manufactured by the various companies are of sufficient interest to warrant the publication of the results.

Standard commercial types of 60-cycle, 1-kw, oil-cooled transformers were obtained from five manufacturing companies. Each transformer is presumed to be representative apparatus as manufactured by the company, and in no way specially constructed. These transformers are designated herein by the letters A, B, C, D and E. Transformers A, B and C are of the core type, while transformers D and E are of the shell type. Each of the transformers is provided with 10 times as many turns in each of its primary coils as in each of its two secondary coils. With the exception of transformer A, which is intended for a primary e.m.f. of 2080 volts per coil, the transformers have been designed for a primary e.m.f. of 2200 or 1100 volts and a secondary e.m.f. of 220 or 110 volts.

Tables I and II give the dimensions of the magnetic circuits of the transformers, explanation of the reference letters being shown in Figs. 1 and 2; the dimensions are given in inches.

TABLE I.—CONSTRUCTIVE DETAILS OF CORE-TYPE TRANSFORMERS.

Core type.	A.	B.	C.	D.	E.	F.	G.
A	9	5 9/16	2½	2 13/16	1⅜	1 7/16	6⅛
B	10½	5¼	3	2¼	1½	1½	7½
C	10	6¾	1⅞	3	1⅞	1⅞	6¼

TABLE II.—CONSTRUCTIVE DETAILS OF SHELL-TYPE TRANSFORMERS.

Shell type.	A.	B.	C.	D.	E.	F.	G.	H.
D	10¼	3 5/16	6⅞	1.89	3¼	1⅜	3.78	1 9/16
E	8½	4⅞	5 7/16	2⅛	2⅛	1 1/16	3 7/16	1

Tests were made of the core loss, the copper loss, and the efficiency under normal conditions as to voltage and frequency (Figs. 3, 4, 5, 6 and 7); the temperature rise at full load and at 50 per cent overload (Figs. 8, 9, 10, 11 and 12); the variation of the core loss with change in frequency at normal voltage

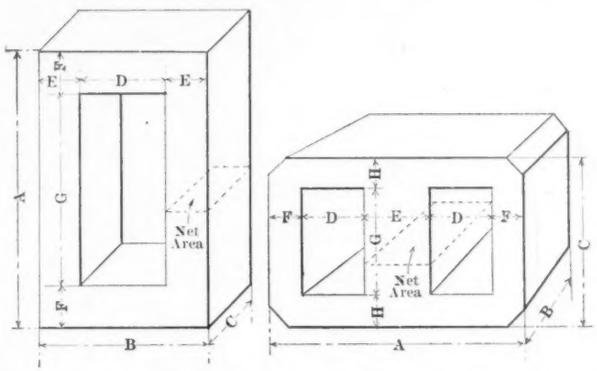
(Figs. 13, 15, 17, 19 and 21), and with change in voltage at normal frequency (Figs. 14, 16, 18, 20 and 22); the all-day efficiency and the regulation (Table III), and the insulation resistance.

LOSSES AND EFFICIENCY.

The core loss was determined, after the transformers had been brought up to their normal working temperature, by connecting the secondaries of the transformers across a supply having the proper voltage and frequency. The reading of a wattmeter in the circuit, with the primary coils open circuited, showed the loss due to hysteresis and eddy currents in the core.

The variation of core loss with a change of voltage, the frequency remaining constant, and with a change of frequency, the voltage remaining constant, was also determined.

The copper loss was determined by observing the resistance of the primary and secondary windings when they were at their normal working temperature, the resistance of the primary winding being reduced to the equivalent resistance of the secondary winding. Use was made of the formulas $W = I^2R$ where W = watts copper loss, I = current in secondary, R = equivalent total resistance of primary and secondary windings. The loss commonly termed "load loss" in transformers was found to be so small in these transformers that it has been neglected in the plotting of the curves.



FIGS. 1 AND 2.—MAGNETIC CIRCUITS OF CORE-TYPE AND SHELL-TYPE TRANSFORMERS.

The efficiency of the transformer was calculated by using the formula, $\text{Efficiency} = \frac{\text{Input Losses}}{\text{Input}}$. All of the losses having previously been determined it was decided to use this method in preference to running the transformer under load and determining the efficiency by the wattmeter readings.

A transformer which is connected in a lighting system has a load on it for only a part of the 24 hours, but the core loss takes place throughout the whole time. The "all-day efficiency," or the ratio of the energy output to the energy input during the 24 hours, is, therefore, of interest. In order to determine this efficiency, the usual conditions of practice will be met if the calculation is based on the assumption of five hours at full load and 19 hours at no-load in transformers operating on ordinary lighting circuits. The "all-day efficiency" for these transformers has been calculated on the above basis, using the following formula:

All day efficiency, in per cent,

$$= \frac{\text{Rated output} \times 5}{\text{Rated output} \times 5 + \text{copper loss} \times 5 + \text{core loss} \times 24} \times 100.$$

The regulation is of importance in connection with the operation of transformers, because the life of the ordinary incandescent or Nernst lamp depends largely upon the voltage impressed upon it. The regulation of a transformer is usually expressed in per cent of full-load voltage, or the per cent

$$\text{regulation} = \frac{\text{No-Load Voltage} - \text{Full-Load Voltage}}{\text{Full-Load Voltage}} \times 100$$ when the primary impressed pressure remains constant. The losses, efficiency and regulation of the five transformers are recorded in Table III.

TABLE III.—LOSSES, EFFICIENCY AND REGULATION.

Transformer.	Total resistance.	Copper loss.	Core loss.	Full-load efficiency.	All-day efficiency.	Per cent regulation.
A	1.340	31.0	33.2	94.0	84.0	2.79
B	1.126	23.2	18.7	95.9	89.8	2.04
C	1.440	29.7	46.8	92.9	79.7	2.72
D	1.007	20.8	39.7	94.2	82.5	2.27
E	1.230	25.4	32.7	94.6	84.5	2.27

TEMPERATURE RISE.

In order to determine the temperature rise the transformers were run under full load until a practically constant temperature was reached and readings were taken of the room and oil temperatures; resistance measurements were taken, by the drop of potential method, of the primary and secondary windings in order that the rise of temperature of the individual coils might be calculated.

The following formula was used for this calculation:

$$\Theta = (238.1 + t)\left(\frac{R_{(t+\theta)}}{R_t} - 1\right)$$

where

Θ = Degrees centigrade rise above the room temperature.

t = Initial temperature in degrees centigrade.

$R_{(t+\theta)}$ = Resistance at temperature elevation $\Theta°$ centigrade.

R_t = Resistance at room temperature $t°$ centigrade.

The above value of rise in temperature must be corrected for a standard room temperature of 25 deg. C. This is done by allowing 0.5 per cent correction for each degree centigrade the room temperature is above or below the normal. Thus, with a room temperature of 35 deg. C. the observed rise of temperature has to be decreased by 5 per cent, and with a room temperature of 15 deg. C. the observed rise of temperature has to be increased by 5 per cent.

Immediately after the full-load run was finished a run of 2.5 hours was made at 50 per cent overload in order to determine the heating under this extreme condition. The curves plotted in Figs. 8, 9, 10, 11 and 12 show the results after corrections have been made for a standard room temperature of 25 deg. C.

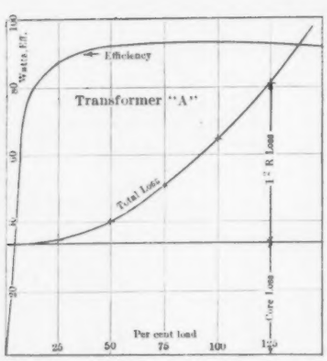
INSULATION.

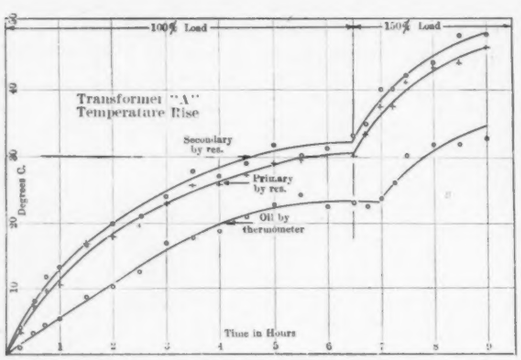
The character of the insulation in a transformer should be of the best, especially between the primary and secondary windings, because poor insulation endangers the life of the consumer every time a lamp is switched on or off the circuit.

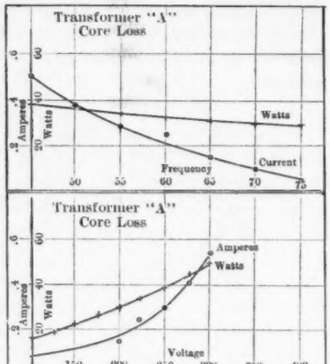
The insulation in transformers other than the single-cotton or double-cotton covering of the circuits themselves usually consists of either sheet fiber or mica over which is wound a number of layers of cotton tape, oiled linen or duck, and red rope paper, between the core and windings; in some transformers all of the above materials are used, while in other makes use is made of only part of them. Between the layers of the secondary windings one layer of thin oiled linen, varnished cloth, or parchment paper is commonly used in addition to the single-cotton or double-cotton insulation on the wire. The secondary winding is insulated from the primary winding by a thickness of either horn fiber or sheet mica over which is wound a number of layers of cotton tape, oiled linen or duck, and paper.

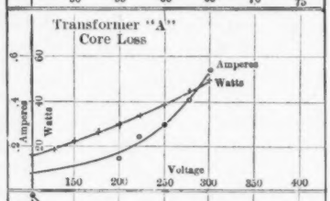
Different combinations of these materials are used by the various manufacturers. In the primary winding the individual layers are insulated from one another with one thickness of heavy oiled linen or varnished paper in addition to the single-cotton or double-cotton insulation on the wire. Around the finished winding there is wound one thickness of heavy oiled linen, varnished paper, or duck, which is held in place by one or two layers of cotton tape.

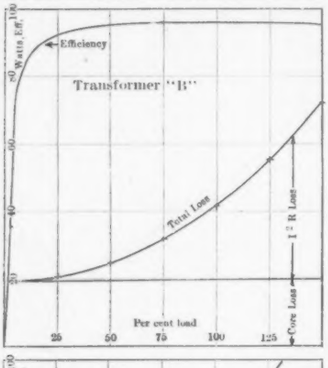
After the winding has been completed it is dried at a high temperature, usually in a vacuum, so as to drive off any moisture that might be present. After the coils have been dried completely they are then treated with one of the many insulating

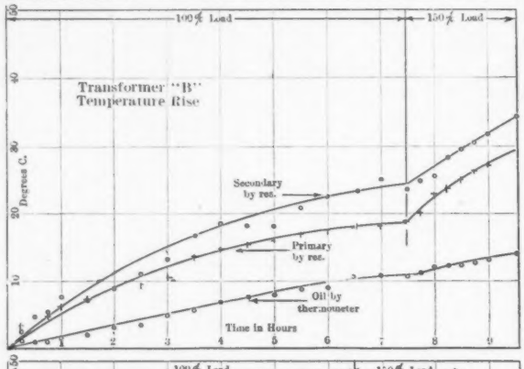


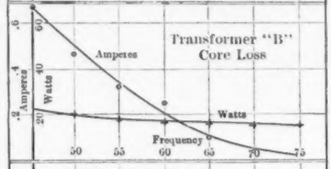


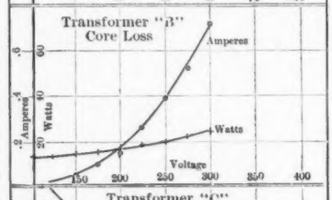


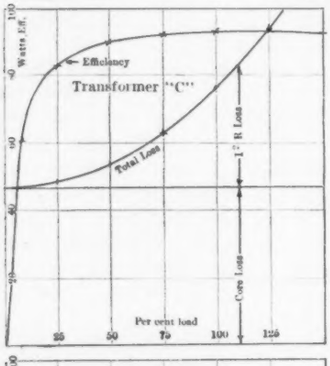


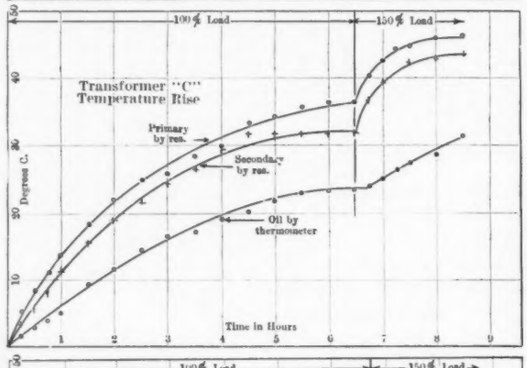


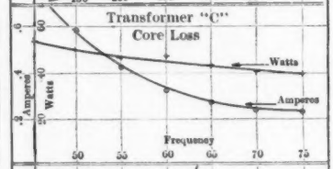


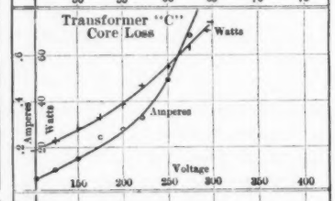


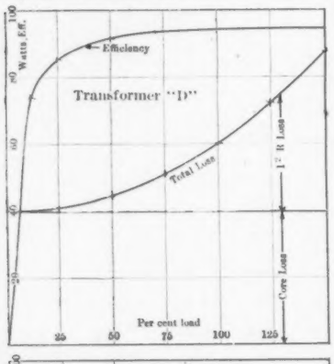


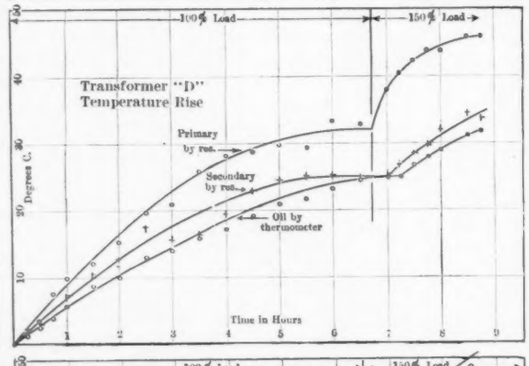


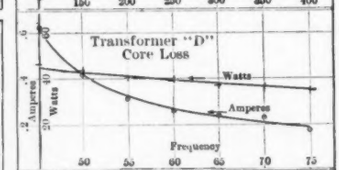


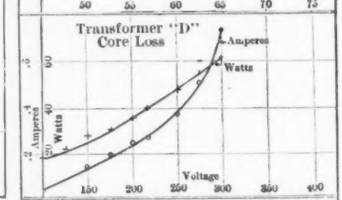


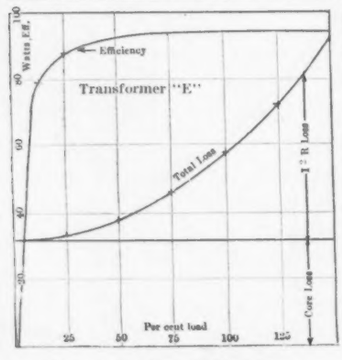


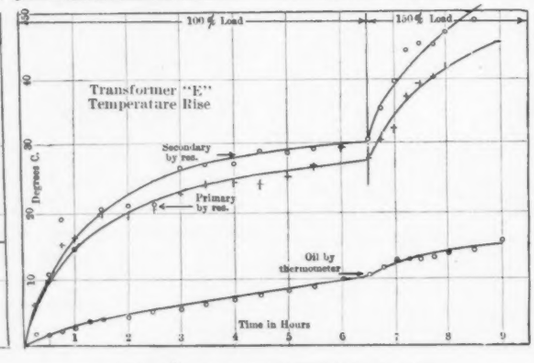


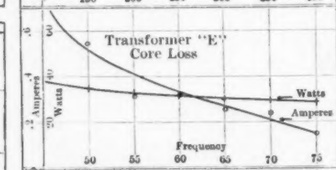


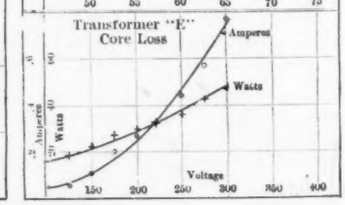












FIGS. 3 TO 7.—EFFICIENCIES. FIGS. 8 TO 12.—TEMPERATURE RISE. FIG. 13 TO 22.—CORE LOSS.

compounds. This is applied under a pressure of from 50 lb. to 100 lb. pressure per square inch so as to make sure that it will penetrate the whole winding. This pressure is maintained for a definite time, after which the coils are taken out and dried. Windings which have undergone the treatment before mentioned are impervious to moisture and the insulation is one solid mass.

A transformer rated at 2200 volts primary should withstand a pressure of 10,000 volts alternating e.m.f. for one minute between the primary and the secondary windings, and between the primary winding and the core. A special high-voltage transformer was used to obtain the required test voltage on these transformers and the voltage was determined as closely as possible by adjusting needle points for a 0.5-in. air-gap, which has been experimentally determined to be practically correct for a pressure of 10,000 volts. Each of the transformers was subjected to the above voltage between the primary and the secondary windings, and between the primary winding and the core for one minute, and the insulation was found to be in every way satisfactory.

CONCLUSION.

It will be seen from the curves showing the rise in temperature that all of the transformers come well within the allowable value of 50 deg. C., according to the Standardization Rules of the A. I. E. E. when operating at full load. When operating at 50 per cent overload the rise of temperature is found to be within the limit with the exception of one transformer, and in this case the slight excess would not be injurious to the insulation of the transformer.

The core loss was found to vary greatly in the different transformers, as will be seen from the curves. The variation was found to be between a maximum of 46.8 watts and a minimum of 18.7 watts. This variation can be accounted for only by a difference in the quality of iron used in the construction of the cores. It will be seen that there is a considerable variation of core loss with change in voltage; the variation with change in frequency is less remarkable.

The copper losses do not exhibit so great variation throughout the transformers.

The commercial efficiencies are satisfactory; the variations between the maximum and the minimum of only 3 per cent is small when the difference in the individual losses is taken into consideration; this fact indicates that the losses in the different types of transformers are proportioned so that the final efficiencies are practically the same for each. This is not true, however, for the "all-day efficiency," in which case the individual losses affect the final results. As will be seen by inspection of Table III, there is a variation of 10.1 per cent in the "all-day efficiency." It will also be noticed that the transformer which has the largest core loss has the smallest "all-day efficiency" and vice versa.

The regulation is shown to vary between 2.79 per cent as a maximum and 2.04 per cent as a minimum, indicating that the regulation for each is about what might be expected for this size of transformer.

In presenting the above results the fact is recognized that the rating of the individual transformers is small, but this fact does not show the tests to be irrelevant or unimportant in connection with installations in the smaller towns where many transformers of similar rating are in use. If the rating of each of the transformers were 5 kw or 10 kw, it would doubtless be possible to determine "load loss" accurately, and also to make a satisfactory separation of hysteresis and eddy current losses in connection with the core loss determinations. The latter appear to be very important in showing accurately the per cent of total core loss due to hysteresis loss, and the per cent due to insufficient attention to the insulation of the laminæ of the core.

The data and significant results embodied in this article were obtained in the Electrical Engineering Laboratory of the University of Texas, by Messrs. B. E. Kenyon and J. A. Correll, instructors in electrical engineering.

Cost of Energy in Nine Central Stations Operating Mixed Equipment.

One of the chief reasons why the cost of energy production and distribution in small central stations is of special interest at this time is the tendency noticeable in many quarters to break away from the traditional methods of generation by steam engines. The use of oil engines in connection with steam-driven machinery and the combination of waterwheel generation with energy production by steam turbines offer many opportunities for the introduction of efficient methods of machinery handling, and enable different types of apparatus to be tested by the severe requirements of commercial service. In a general way one must look to the small station for data showing what can be done with a wide variety of equipment under definite conditions. The larger plants are generally required to co-ordinate their equipment more closely, on account of the advantages of standardization where considerable investments are at stake. Symmetry of design has its attractive features in the small station, but the cost of trying out different apparatus combinations is less influential from the investment side. Another point worth considering is that with the improved types of motive power now available for practical application in central-station service, it is not necessary to install units of great size and correspondingly high cost in order to obtain very respectable figures of production economy.

In the following paragraphs the cost of energy production is given for nine different central stations in Massachusetts having mixed equipment, or departing from the usual steam-plant standards of operation through the use of oil engines and waterwheels. No plant of any notable size in Massachusetts is able to generate energy exclusively by water power. Whether this will always be the case is open to question, since the growing interest in the co-ordination of small water powers and their operation in a single system of hydro-electric plants and distribution lines is likely to spread more generally through Massachusetts with the extension of such plans as those of the Connecticut River transmission interests in the Worcester County section. The majority of the larger stations of the State depend upon coal alone, and figures of operating cost for the principal plants of this type have already been published in these columns. The plants using other than the orthodox steam equipment are mainly small stations, with the exception of that of the United Electric Light Company of Springfield. The thoroughness with which these are required to report annually to the Massachusetts Gas and Electric Light Commission enables the following figures to be presented for the year ending June 30, 1908:

Taking up the plants in alphabetical order, the first considered is the Cape Light, Heat & Power Company of Provincetown. This plant is a Diesel oil-engine station, and has practically no motor business except a small pumping load. The equipment of the station consists of two 120-hp American Diesel engines with 12-in. x 18-in. cylinders, the normal speed being 220 r.p.m. The plant was operated by two men, with the services half the time of an extra helper on the repairs of the engine and line. There is also a superintendent. There are a Fort Wayne three-phase, 2300-volt, 85-kw alternator and a 90-kw Stanley alternator, both running at 900 r.p.m., belted to the engine equipment. The equipment is housed in a station building 45 ft. long by 35 ft. wide, and one of the engines and generators was added during the past fiscal year. The total energy generated and delivered at the switchboard was 94,244 kw-hours, and of this 85,643 kw-hours were sold, making a transmission and distribution efficiency of 91 per cent. The generating cost was $4,952, the items of special interest being: Fuel (oil and coal), $2,035; lubricating oil and waste, $227; water, $30; wages at station, $1,844; engine repairs, $573; electric plant repairs, $175. The total cost of production per kw-hour generated was 5.3 cents; the engines consumed 27,810 gal. of oil, costing an average of 4 cents per gallon. For pumping purposes, 24,990 kw-hours were sold. There were produced 3.4 kw-hours per gallon

of oil. The average load on the plant switchboard figured on a 24-hour basis was only 10.8 kw, or 14.3 kw on an 18-hour day. These figures show that the plant is at present unable to realize the full efficiency of the engines on account of the small output. Provincetown is not provided with manufacturing facilities of any magnitude, and the motor market is restricted. In view of the economy shown by oil engines in other plants to be covered below, the above figures cannot be called representative. The operating conditions are adverse, and the costs are necessarily high.

The distribution cost at Provincetown for the year was $1,213, or 1.42 cents per kw-hour sold. This cost was made up of wages for the care of lamps and meters, clerical labor and cost of collection, $284; line repairs, $119; meter and lamp repairs, $443; lamps, $366. The use of 2300 volts for distribution over the short distances necessary in this community enabled a relatively better economy of distribution to be secured than was possible in the station itself.

The Gardner Electric Light Company was operated by an oil engine equipment, consisting of three 225-hp, 16-in. x 24-in. Diesel engines running at 172 r.p.m. The company also operated to some extent two Fitchburg engines of the simple type, one being a 15-in. x 30-in. and the other a 28-in. x 30-in. machine, of 150 hp and 100 hp respectively. Four generators of Stanley make are in service, the total rating being 415 kw. The station building is a 73-ft. x 53-ft. structure, with a 26-ft. x 47-ft. boiler house, containing one Dillon boiler of 150-hp rating. The total energy generated was 654,690 kw-hours. The energy sold was 468,593 kw-hours, giving a distribution efficiency of 72 per cent. There were 157,462 kw-hours sold for motor service, and 13,293 units for electric heating. The company burned 465 tons of coal at a cost of $4.61 per ton, and 75,195 gal. of fuel oil at a cost of 4.1 cents per gallon. The output per gallon was 8.7 kw-hours. The operating force consisted of four engineers, one fireman, one helper, or six station attendants. Five linemen and one meter man were also employed. The total cost of manufacture was $13,953, or 2.14 cents per kw-hour. The principal items were: Fuel, $5,484; oil and waste, $507; water, $90; station wages, $5,352; engine plant repairs, $1,080; station repairs, $404; electric plant repairs, $740. The fuel and wages cost per kw-hour were each about 0.8 cent, making up about 75 per cent of the cost of production. Engine plant repairs were about 0.17 cent per kw-hour. There has been considerable interest expressed from time to time lately in different quarters as to the repairs necessary with the oil engine. These figures show that the total repairs for the year apportioned over the three engines cost not much over $2 per kilowatt of normal rating. If one engine had been taken out of this reckoning, the apportioned repairs would still have been only approximately $3 per kilowatt, which is far from an excessive figure in a type of prime mover of as recent development as is the oil engine.

The cost of distribution at Gardner was $6,737, or 1.44 cents per kw-hour sold. The main items were: Line repairs, $2,722; maintenance wages for lamps and motors, $1,646; and lamps, $1,536.

The Great Barrington Electric Light Company operates a combined steam and water-power installation. The use of the latter portion of the installation as far as practicable produced a saving of 1.52 cents per kw-hour generated. The equipment of the company consists of a 150-hp, 15-in. x 14-in. engine; a 150-hp Dillon boiler, and three 113-hp vertical Hercules waterwheels 45 in. in diameter and operated on a 10-ft. head. The power house equipment was operated by two men, and the total energy generated and delivered at the switchboard was 650,640 kw-hours. The total energy sold was 484,359 kw-hours, and the efficiency of distribution was 74.5 per cent. The principal items of the production cost were: Fuel, $355; purchased water power, $3,095; wages, $2,757; electric plant repairs, $798; total, $9,887. The distribution cost was $3,581, or 0.74 cent per kw-hour sold, of which the main item was line repairs and renewals, $1,474.

The Greenfield Electric Light & Power Company operates a combined engine and waterwheel plant containing the following principal equipment: Three 250-hp Hazelton boilers, and one 600-hp Stirling boiler; one 500-hp compound Russell 31½-in. x 20-in. x 27-in. engine; one Buckeye 265-hp engine; one Harris 600-hp engine; and one McIntosh & Seymour 750-hp engine. The waterwheel installation consists of two 600-hp Stilwell-Bierce & Smith-Vaile turbines, 30-in. diameter, running on 35-ft. head, driving two General Electric 40-kw generators. The total electric generating equipment in the plant is rated at 2100 kw. This equipment is disposed in two stations, one being a water-power plant located in the town of Buckland, at Gardners Falls, and the other a steam station located in Greenfield. The steam plant was operated by four engineers and three firemen, and the water-power station by three engineers and four helpers. At the steam plant the company burned 2117 tons of coal, costing on the average $4.26 each. The total energy manufactured was 3,961,470 kw-hours. The Greenfield company sold 3,354,169 kw-hours, and its maximum load was 1160 kw.

The generating cost was: Fuel, $9,012.50; wages, $11,440.66; total, including miscellaneous, $25,336.90; purchased energy from the Turners Falls Electric Company, at 0.5 cent per kw-hour, $3,588.60. The station cost per kw-hour manufactured was 0.64 cent, and the distribution cost, 0.36 cent per kw-hour sold. The company's output included a motor sale of 585,087 kw-hours, and a railway load of 2,329,676 kw-hours. These conditions produced an unusually good load factor for a plant of this rating, and tended to reduce the cost of manufacture. The utilization of water power was also a decided aid in securing good station economy.

The Orange Electric Light Company generated 196,250 kw-hours, and sold 171,626 kw-hours. There was a motor output of 15,759 kw-hours. This company operated a combined steam and water-power station, the bulk of the load being carried on the waterwheels. The station equipment consisted of one 220-hp Stirling boiler; one 300-hp McIntosh & Seymour engine; two 115-hp Rodney Hunt turbines 36 in. in diameter, and one 154-hp Rodney Hunt turbine, 42-in. diameter, all operating under 16-ft. head. The generators consisted of two 250-kw General Electric alternators of a combined rating. The company burned 34 tons of coal costing $4.44 per ton, and the station was operated by two engineers, with one electrician also on the company's payroll. The total cost of manufacture was $3,844.42, or 1.96 cents per kw-hour, and the distribution cost of the company was $2,898.17, or 1.69 cents per kw-hour sold. This plant with increased power output would undoubtedly be able to realize improved efficiency of production, in view of the possibility of carrying so much of the load on the waterwheels for a considerable period.

One of the larger mixed systems of the State is that of the Pittsfield Electric Company. This central-station organization had a total generated energy during the fiscal year of 2,389,479 kw-hours. It sold a total output of 1,920,495 kw-hours, of which 416,774 kw-hours were for motors. The maximum load on the system was 847 kw. The company operated two plants, one a steam station in Pittsfield on Renne Avenue, and the other a Diesel oil engine station at Silver Lake, in the suburbs of the city. The total station attendance included ten engineers, four firemen, one wiper and one repairman. The company burned 3452 tons of coal at an average cost of $2.85 (hard coal) and 3681 tons of bituminous coal at an average cost of $4.98. The equipment of the steam station was as follows: One 150-hp Russell boiler, and six 150-hp Bigelow boilers; two 175-hp Harris engines; two 500-hp Providence engines; one 200-hp Westinghouse engine, and one 150-hp Westinghouse engine. The total cost of energy manufacture was $41,386, or 1.73 cents per kw-hour. The total distribution cost was $24,791, or 1.29 cents per kw-hour. The company purchased 36,539 kw-hours at a total cost of $543, or 1.49 cents per kw-hour.

The cost of operation at the oil engine plant, containing two 225-hp American Diesel engines, directly connected to generators, was as follows: Total energy generated at station and delivered at switchboard, 817,000 kw-hours; fuel oil consumed, 87,058 gal.; average cost per gallon, 3.9 cents. Cost of manufacture

per kw-hour: Wages, $3,612.87; fuel oil, $3,400.76; water, $87.70; oil and waste, $347.22; repairs oil engine equipment, $662.91; station repairs, $4.73; electric plant repairs, $12.51; total, $8,128.70. These figures show that the oil engine plant is producing energy at a net cost of about 1 cent per kw-hour, with a labor cost of 0.44 cent, and a fuel cost of 0.41 cent per kw-hour. The repairs came to 0.081 cent per kw-hour; as far as this station's operation at this period of its life is concerned, maintenance is far less than what many engineers have been disposed to attribute to the oil engine station. Subsequent figures from this station will be awaited with interest. The returns of this company do not enable one to separate the steam plant costs, but these seem to be kept well in hand, considering the relatively high cost of coal and the moderate size of the reciprocating engines operated, otherwise their influence on the total cost per unit would have been more adverse.

One of the smaller stations in the State is that of the Shelburne Falls Electric Light Company. The returns of this plant for the year ending June 30, 1908, cover the operation of a plant containing a single generating unit, driven by a 45-hp Westinghouse gasoline engine, and an 85-hp Rodney Hunt 18-in waterwheel operating under 32-ft. head. The generator was a 60-kw Westinghouse unit. The plant was operated by one dynamo tender and one helper. It consumed 1630 gal. of gasoline at a cost on the average of 12.5 cents per gallon. The detailed cost of operation was: Gasoline, $203.75; water-power rental, $500; wages at station, $1,150.50; total, $2,412.44, giving a cost of manufacture per kw-hour of 3.17 cents. The plant turned out 76,150 kw-hours, and sold 73,808 kw-hours, all for lighting service, with no motor load. The total distribution cost was $1,357.28, or 1.84 cents per kw-hour sold. The use of the belt drive and the absence of a motor load, together with the small size of the plant, were predisposing factors tending toward high cost per kw-hour generated.

Probably the largest plant in Massachusetts at the present time that depends upon both steam and water power is that of the United Electric Light Company of Springfield. This company manufactured during the year a total of 16,230,797 kw-hours, and sold 10,421,309 kw-hours. There are several water-power units supplying energy to this company's territory, and there is a combined steam engine and turbine plant in the neighborhood of the business center of the city of Springfield. The steam-boiler equipment consists of three 300-hp and 11 400-hp Hazelton & Williamson boilers. The steam generating units are one 800-hp Corliss-Providence compound condensing engine; three 1000-kw Westinghouse-Parsons steam turbines, and one 2500-kw turbine of the same make. The waterwheel equipment totals 2835 hp. The maximum load was 6701 hp. The operating force included eight steam engineers, three firemen, one chief electrician, and fourteen dynamo men. The total cost of manufacture was $116,884, the principal items being: Fuel, $40,108; wages, $29,753; and water power, $34,560. The generating cost per kw-hour was 0.72 cent, and the distribution cost per kw-hour sold, 0.685 cent. The influence of the water-power generation and the skilful operation of the steam plant as an auxiliary is clearly evident in the excellent generating efficiency obtained. The different plants operated by this company are closely tied together by a thoroughly organized telephone system and carefully trained organization, with a liberal application of labor-saving equipment in the stations.

The Weymouth Light & Power Company operated a plant consisting of 450 hp of Hodge & Roberts boilers, one 500-hp McEwen engine, one Harrisburg 250-hp engine, and one 250-hp Slatter engine. The company also has two Rodney Hunt turbines 21 in. in diameter. The operating force consisted of two engineers, one fireman and one engineer at the water-power plant, and the maximum load was 450 kw. The company burned 1626 tons of coal at an everage cost of $4.59 per ton, and 740 tons of screenings, costing an average of $2.52 per ton. The total cost of operation was $19,615, of which fuel was $9,329 and wages $5,718. The cost of manufacture was 2.45 cents per kw-hour. The distribution cost per kw-hour sold was 0.94 cent.

Series Tungsten Lighting.

In a paper read before the Northwestern Electrical Association convention at Milwaukee, Jan. 20 and 21, Mr. Henry Schroeder discussed the subject of series tungsten lighting. Street lighting as a whole has not, he said, received proper attention in the past, and being most prominent in the eyes of the public, careful consideration should be given to it by the central station. In the opinion of the author, incandescent lighting for suburban and residential streets is the ideal system. It was stated that five large arc-lamp installations in New England in outlying districts are now being replaced by clusters of tungsten series lamps. In sparsely settled districts, in order to obtain a reasonable illumination between lamps, the greater cost of arcs does not warrant their proper spacing. Moderately low candle-power units, spaced at frequent intervals, will much more economically light a street. Over a year ago the series tungsten lamp was developed, having an economy of 1.25 watts per candle, and reports from many sources covering many thousands of lamps show an average life of over 1500 hours.

These lamps are now made in 25-, 32-, 40-, 60- and 80-cp sizes for currents of 3.5, 4.0, 5.5, 6.6 and 7.5 amp, and also in candle-powers of 25 to 60 for 1.75 amp. The greater life of the series over the multiple tungsten lamp is largely due to the greater cross-section of the filament, and from reports received vibration caused by linemen climbing poles and driving bolts, passing traffic, wind storms, etc., do not affect the lamp. One advantage of the tungsten over the carbon series lamp is that the tungsten gives equally good results on all amperages, not requiring one circuit for incandescents and another for arc lamps, as has been the practice with carbon lamps used for this purpose.

The economy of the tungsten series lamp is twofold: First, in the kw-hour saving per year, and, second, in the capacity of transformers and station apparatus. As an example of the former advantage, in the case of the 32-cp lamp burning 4000 hours, all night, every night for a year, the carbon lamp consumes 112 watts, or 448 kw-hours, for a year, while the tungsten lamp consumes 40 watts, or 160 kw-hours, per year, giving a saving of 288 kw-hours. At 2 cents per kw-hour this saving is $5.76 annually. Assuming four renewals of the carbon lamp and three of the tungsten lamp per year, the extra cost of tungsten renewals for central stations which use 1000 to 5000 lamps of all kinds per year will be $1.45 annually, making a net saving, including power and lamp renewals, of $4.31 annually. At an energy cost of 1.5 cents per kw-hour the annual net saving due to the substitution of the tungsten lamp will be $2.87.

In competition with gas or gasoline mantle lamps the tungsten lamp can easily give better service at profitable rates. From tests made in several cities on the mantle lamp, while operating under actual conditions, the following data were obtained: Maximum candle-power found anywhere, 55.1; highest average candle-power found in any city, 36.7; lowest average candle-power found in any city, 16.8; minimum candle-power found anywhere, 6.5. Thus a 40-cp tungsten series lamp which maintains its candle-power practically constant throughout life will certainly give better results than the mantle lamp, even though the Welsbach mantle lamp is rated at 60 cp.

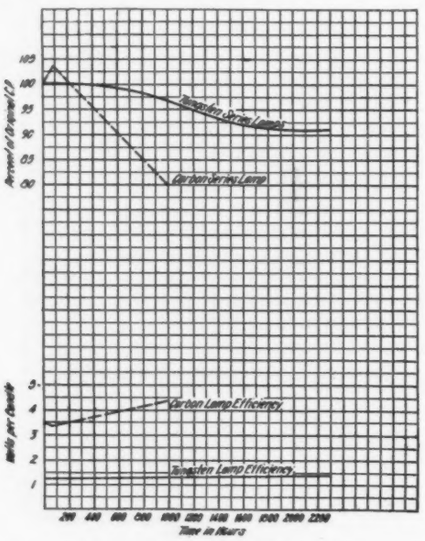
The illustration shows the life and candle-power curves of the carbon and tungsten series lamps. The tungsten lamp maintains its candle-power better throughout its life. The new "radial-wave" reflectors increase the candle-power of the lamp from 8 to 25 deg. below the horizontal about 25 per cent.

To short-circuit in case of an open circuit on the lamp, a series socket with a film cut-out is used. The receptacle is so constructed that the lamp and socket can be removed at any time without opening the circuit. A new brass disk film cut-out has been made that will readily puncture on 200 volts, which effectually overcomes the troubles previously encountered with sockets burning out due to the failure of a mica film to

puncture when the lamp burns out. This cut-out consists of two round brass plates about ¼ in. in diameter, which are held together and insulated from each other by a piece of veiling and some varnish. On account of the high efficiency of the tungsten lamp, the series lamp business has increased enormously in the last six months. The customary practice for central stations in changing over from carbon to tungsten lamps has been to give the town some of the benefits by changing from 25-cp carbon to 32-cp tungsten, etc.

DISCUSSION.

Mr. Ludwig Kemper, of Albert Lea, Minn., objected to the method of figuring saving in power at the rate of 1.5 or 2 cents per kw-hour. Assuming a small central station were to reduce its kilowatt output by the substitution of tungsten for carbon street lamps, the actual saving would not amount to 1.5 or 2 cents per kw-hour of energy reduction. The station labor and other maintenance charges would remain fixed. The only place where it could make a difference would be in the coal consumption, and the reduction in kw-hour output would not reduce the coal consumption to the amount named per kw-hour, because of the large fixed losses in the boiler and engine plant, which would remain unchanged. He said that he had actually tried some experiments along this line to determine the possible saving by reduction of load corresponding to that



LIFE AND CANDLE-POWER CURVES OF CARBON AND TUNGSTEN LAMPS.

caused by the adoption of tungsten street lighting, and the actual amount of coal saved owing to the reduction in load was so small it could hardly be noticed.

Mr. J. R. Cravath, of Chicago, said that Mr. Kemper was probably right as regards reduction in power cost. In his opinion the greatest value of the series tungsten lamp in such a case would be the station capacity set free to be sold to other consumers. In a growing station such capacity soon finds a market.

President Korst, of Janesville, said that he was operating a water-power plant where the reduction in power would cause no saving, but he had been replacing series carbon with series tungsten lamps for two reasons. One was that he could get more revenue out of a given station capacity, and the other was that the series carbon lamp blackens, so that it is not very satisfactory; on the ground of satisfying the public he thought it wise to substitute the tungsten series lamp for the regular carbon series lamp.

Mr. G. E. Newman, of Ladysmith, Wis., said that arc lamps caused more trouble than any other one thing in the operation of a small plant. He was interested in this paper as showing the possibility of substituting tungsten clusters which would not be so subject to outage and consequent strenuous objection of the alderman living on that corner.

Employer's Liability—The Fellow-Servant Rule or the Doctrine of Common Employment.

By John E. Brady.

While, generally, one person cannot be held responsible legally for the wrongful acts of others, there is a time-honored exception to the rule to the effect that an employer is liable for the negligence of his employee, when the latter is acting in pursuit of his master's business and within the scope of his employment. This modification of the general rule is subject to a further, also time-honered, exception, known as the fellow-servant rule or the doctrine of common employment, and which may be stated as follows: Where an employer uses due care to select competent servants and provides them with suitable means of accomplishing the work for which they are employed, he is not liable to one servant for the consequences of the negligence of another, while both are engaged in the same service. It may be mentioned in passing that the fellow-servant rule is not law in Mexico nor in the Province of Quebec. Consequently, in those jurisdictions an employer is not exonerated from liability for injuries to one in his service by reason of the fact that the injuries were caused by the negligence of a fellow servant of the employee.

The case of Priestly v. Fowler, 3 M. & W. 1, an English decision of the year 1837, is sometimes accredited with being the first to apply the fellow-servant rule. This contention, however, is not borne out by an examination of the facts. The plaintiff was in the employ of the defendant, who was a butcher by trade, and was injured by reason of the breaking down of the wagon on which he was riding and which was being driven at the time by another of the defendant's servants.

The history of the fellow-servant rule in the United States is said to have begun with the case of Murray v. South Carolina R. Co., 1 McMull. L. (S. Car.) 385, 36 Amer. Dec. 268, decided in South Carolina in 1837. It was here held that a railroad company was not liable to a fireman in its employ for injuries resulting from the negligence of a competent engineer. The ground most generally assigned for the fellow-servant rule is that when one enters the employ of another he assumes the risk of being injured by the negligence of others engaged in the same employment. In a leading American decision it was said: "We are not aware of any principle which should except the perils arising from the carelessness and negligence of those who are in the same employment. There are perils which the servant is as likely to know, and against which he can as effectually guard, as the master. They are perils incident to the service, and which can be as distinctly foreseen and provided for in the rate of compensation as any others." Farwell v. Boston, 4 Metc. (Mass.) 49.

So, public policy is frequently asserted as the true basis of the fellow-servant rule. It may be said to be founded upon the theory that it is calculated to make servants in a common employment watchful of each other, and thereby to promote carefulness in the performance of their duties, Burke v. Norwich, etc., R. Co., 34 Conn. 474. 480, where, however, it is said: "It is by no means certain that the public interest would not be best subserved by holding the superior, with his higher intelligence, directing and discharging subordinates, to the strictest accountability for their misconduct in his service, whoever may be the sufferer from it."

It would seem that the safety and welfare of the public would demand the establishment of the non-liability principle on the part of the employer in such cases, for when established it can work no injury to the servant, because his entering upon the service is voluntary, is with a knowledge of the hazards of the work, and with a right to demand such wages as he shall deem compensatory. If this be taken as the true ground of the rule it would follow that the rule should be confined to those servants whose duties bring them into such juxtaposition that one would be able to observe the negligence of his fellows, and this limitation is recognized in some cases. IV Cyc. 1280.

Since its first adoption the fellow-servant rule has been applied in thousands of cases, arising in every jurisdiction of the United States. In Rosa v. Volkening, 72 N. Y. Supp. 236, the plaintiff was employed by a contractor engaged in the construction of a building, his work being to wheel cement from a dock near at hand to the building, and to perform such other services in connection with the construction as he was directed to do by those in charge. In the course of the work it was found necessary to use a derrick to hoist timbers into position, and in raising them it was necessary to give them a forward movement while they were being lifted. On the day of the accident, the laborers operating the derrick, which was a crude three-legged affair, with a drum worked by levers, made a hitch upon a piece of timber, fastening the rope farther from the end than usual, and in such a manner that the dragging of the timber forward threw an excess weight upon the derrick, and it toppled over, falling upon the plaintiff and causing the injuries for which he brought suit. On the ground that the place furnished for the plaintiff to work in was made dangerous, not by the presence of the derrick, but by the negligence of the plaintiff's fellow servants in operating it, it was held that the contractor was not liable.

In a Missouri case, Strottman v. St. Louis, I. M. & S. Ry. Co., 109 S. W. 769, a station telegraph operator and a locomotive engineer, both working for the same company, under the control of and subject to the orders of the company's train dispatcher, and with no control of either one over the other, were held to be fellow servants, both at common law and within the fellow-servant law (Laws 1897, p 97, Sec. 3), providing that persons, engaged in the common service of a railroad, working together at the same time and place, to a common purpose of same grade, neither of such persons being intrusted with any superintendence over his fellow employees, are fellow servants with each other, provided that no agent or servant shall be a fellow servant with an agent or servant of the common master engaged in another department or service of the master.

The plaintiff and a co-worker, in another instance, were employed at the defendant's railroad station in transferring baggage on trucks from the trains to the baggage room. The baggage was lowered by an elevator from the train platform to a subway some 16 ft. below, and then taken to the baggage room. When the elevator was down a cage protected the aperture at the surface, and as the elevator ascended the cage descended, and when it descended the cage ascended, passing the elevator both ways. The elevators were almost a foot longer than the baggage trucks and somewhat wider, so that, if the baggage was not loaded to protrude more than that distance beyond the elevator, it would not strike the cage in ascending and descending. In lowering baggage it was customary for the head man at the truck to see that the baggage was in a proper position to be elevated; the plaintiff and another loaded a truck, the other being at the head of the truck, and after it was loaded the other employee called to plaintiff to go ahead, and he started the elevator, which came into contact with the descending cage on account of the baggage having protruded too far from the elevator, and plaintiff was compelled to jump from the elevator and was injured. It was held that plaintiff's fellow employee was negligent in not seeing that the baggage was properly loaded, and that the defendant was, therefore, not liable. Turner v. Terminal R. Ass'n of St. Louis, 111 S. W. 841.

The question as to who may be considered fellow servants is one which frequently arises. A hydraulic elevator in a steel works not being a machine whose condition as to safety is constantly changing with its use so as to require from the persons tending it, as part of the ordinary use of it, reconstruction or readjustment of parts as they become worn out or displaced, for materials or new parts supplied by the master for that purpose, the operator of the lever of the elevator and the millwrights were held not to be, respecting the performance of duties of inspection and repair, fellow servants of one employed to operate an electrical locomotive in pulling ladle cars onto the elevator. Byers v. Carnegie Steel Co., 159 Fed. 347.

It is generally recognized that the master is exempted from liability for injuries to an employee by the negligence of a fellow servant only where the injured servant was at the time of the injury engaged in the performance of his duty under his employment. In a case which involved this rule, it appeared that the plaintiff was employed by the day as brakeman on a work train. Twelve hours was a day's work, and the train had no regular run. As a rule the crew worked from 6:30 a. m. to 6:30 p. m., and did not work at night. On the morning of the injury plaintiff started out to find the train. Not finding it in the yards, he walked down the track to a roundhouse, where he ascertained that the train had gone, and that he was therefore not subject to call for duty that day. He decided to quit defendant's employ, and started back up the track to see an acquaintance when he was struck by an engine and tender while crossing a bridge. It was held that he was not in the service of defendant when injured, and that the fellow-servant rule did not apply so as to exonerate the defendant. It was further held that even if plaintiff at the time of the injury were on his way to defendant's agent to obtain a pass with a view of overtaking the work train, he would not have been in defendant's employ, since it was optional with defendant whether it should give him a pass, and, as the employment was by the day, neither party was bound except for the day's employment, but if the contract were to continue longer than the day it would seem to be under a new implied contract each day of service. Missouri, K. & T. Ry. Co. v. Hendricks, Texas Civil Appeals, 108 S. W. 745.

Splicing Lead-Covered Cables.

In telephone work it is usual when making a splice to pour hot paraffin where the lead is removed, to prevent moisture getting into the cable. A scheme which has been tried successfully to accomplish the same result in distribution boxes is to use a blower like that employed to force air into a manhole and to connect an ordinary stove-pipe elbow in the intake. Under the pipe a gasoline stove is placed, and the heated air pumped through a pipe and against the exposed conductors. Moisture is thereby excluded.

Turning and Grinding Commutators.

By W. Burns.

On a well-designed machine, and where some little attention is given to the running condition of the commutator and brushes, the commutator will run for years and not require any truing up operations beyond an occasional polish with carborundum cloth, or, should a tendency to form ridges be shown, it should be touched up with a fine file, then polished with carborundum cloth, before the ridge develops to any extent. This will keep it trued up and avoid heating and sparking.

Nearly all dynamos and motors are allowed some end play on the shaft, varying from ⅛ in. to ¼ in. in different machines, to permit the armature core to run in the center of the magnetic field, and to prevent the commutator from being grooved. The slight movement to and fro which usually occurs when the machine is running keeps it from grooving, and tends to wear it smoothly all over.

The brushes should be so spaced that there is the same rubbing surface at all parts of the commutator, and that no part is left untouched. If the brushes are thus set, and a little attention given to cleaning, with occasional slight lubrication, the commutator will run for a long time and give no trouble.

It is not every motor that is well looked after; the carelessness in this respect with some of the more common sizes of machines being very great, especially if the motor is in charge of an unskilled person, whose ideas on the subject may be very vague, or, if the machine should chance to be placed in a position where it is not easy to get at, it is often neglected till it is absolutely necessary that some attention be given to it. As the bearings require no attention for oiling, and the brushes very little, just so long as the shaft continues to turn the

motor is never looked at, and running under these conditions it is little wonder that the commutator soon requires turning up.

In the smaller sizes, where the armature can be easily removed from the machine, the turning up is best done in the lathe. Centers for this purpose are usually made in the armature shaft, when the machine is being built. After the key has been drawn from the pulley or gear which is on the end of the shaft, the bolts which hold the end bearing in place are unscrewed and the bearing drawn off. Packing should first be placed between the two bottom pole faces and the armature core, to prevent injury to the windings, thin pieces of wood or cardboard being very suitable. The armature may then be withdrawn by hand, if light enough, or by rigging up a chain block if it is too heavy to handle, great care being taken to avoid knocking it in any way. It is then placed on the lathe centers.

If the shaft has been in use for some time and the journals show signs of wear, it will be necessary to apply an indicator to the journals to make sure that they run true. Should they be slightly out of true, the center must be scraped with a center scraper till both journals run properly. If no attention is paid to this point and the commutator is turned up without shifting the center, when the armature is replaced in the machine, the commutator will probably run hot and spark at the brushes, necessitating re-turning in a very short time.

A narrow, pointed tool, somewhat like a thread-cutting tool, is the most suitable for turning the commutator, the turning speed being as fast as the tool will stand, and the feed very fine. A broad-nosed tool ought not to be used, as it is liable to burr over the segments. The sharp-pointed tool does not produce a finished surface, but this is easily attained by filing lightly with a very fine file, then polishing with coarse and fine carborundum or sandpaper. If a little oil is used when finishing with the fine carborundum cloth, it will produce a nice, smooth polish; or, should the electrician think that this will harm the insulation, a little paraffin or a piece of a paraffin candle may be used. A covering of some sort should be placed over the windings and tied in position to keep any particles of metal from getting in during the turning operation. At the points where the windings are soldered to the commutator lugs, a brush should be used to remove any dust or particles of copper. The insulation between the segments should be examined after turning to see that the commutator is not short-circuited by a chip or burr of copper.

Before removing the armature from the lathe, any rough parts on the bearings should be filed and polished with emery cloth. The armature is sometimes given a coat or two of shellac varnish before replacing, but during this operation great care should be exercised, as a knock against the commutator or armature windings may undo all the work.

When the armature is too large to be conveniently taken out, a portable turning rig may be used to true the commutator in place, this rig being fixed to the end bearing or the frame of the machine. The same tools are used as when the turning is done in the lathe; all parts where chips may lodge and harm the insulation being carefully covered. The engine usually requires to be run slowly or disconnected during the turning operation, the armature sometimes being rotated by hand or by means of some portable motor, depending entirely on the material that is accessible. This turning rig is usually a slide rest of some description fitted with a traversing screw and means for feeding in the tool. Sometimes an ordinary lathe slide rest is used, being suitably mounted and clamped in place. A portable grinding machine is often used for truing up some of the larger-sized commutators.

In this connection the truing up of the commutator on the dynamo which supplied the electrical energy for a large works may be of interest. The commutator was giving trouble by undue heating, and, as a flat had formed, it was decided to true it up and see if that would improve matters. To avoid stoppage of the work, it was arranged to be trued up at night after work had stopped. To attach the grinder to the machine, the four cap bolts on the bearing were removed and four longer bolts were inserted to allow for the thickness of the bars which formed the base of the grinding fixture. The grinding wheel was driven from the commutator by means of a rubber-tired wheel held in contact by a spring which could be adjusted to any desired tension. A coarse and a fine wheel were used in turn. The machine automatically traversed back and forward, the feeding in of the wheel being done by hand. A coarse-grained wheel was used to remove most of the material, the engine being run at nearly full speed, as this was when the wheel seemed to cut most freely. After the flat had been ground out, the fine-grade wheel was put on, and soon brought the surface to a fine finish. A final smooth-up with fine carborundum cloth finished the job. The top part of the brush carrier ring had to be removed to make clearance for the grinding rig; the bottom half was left in place and pressure taken off the brushes. This allowed them to slide back in their holders, after which a cloth was passed underneath to catch the copper dust, of which there was a large amount. The armature was also completely covered. When the brushes had been replaced and the machine run for some time, there was no further trouble from heating.

Renewing Incandescent Lamps.

In a recent patent having for its object to prevent the renewal of incandescent lamp filaments, the following description is given of the various manipulations in removing an old filament and substituting a new one:

In the ordinary lamp the platinum ends of the leading-in wires have each a free or interior portion projecting beyond the stem, which is ordinarily equal to or greater in length than the remaining sealed-in portion of the wire. When the filament is initially installed, the filament is placed with its ends in overlapping relation to these projecting leading-in wire ends and cemented thereto by joints of graphite paste.

After the lamp has been perforated at its tip the pasted joints are easily broken and the old filament ends pulled free by any suitable tool inserted in the bulb and the filament broken up and withdrawn through the small opening in the bulb end. The platinum ends are then scraped or raked free of the old paste, this being ordinarily performed by a tool having a claw foot with a V-shaped opening, which is drawn lengthwise the wires and simultaneously turned to scrape them clean. The new filament having been inserted, also through the small perforation in the end of the bulb, and its ends held in juxtaposition to the platinum ends by one tool, a second paste-carrying tool is inserted and paste wiped around the adjoining ends of the filament and leading-in wires, to secure the new filament in place.

Minor Power House Economies.

There are very few power houses where strict vigilance on the part of the operators will not oftentimes result in startling economies. So many joints are susceptible to leakage, and this leakage so hard to detect by observation, that the manager is not aware of the constant losses taking place, unless a systematic search for these is instituted. Mr. R. M. Jennings, in a paper recently read before the Alabama Light & Traction Association, pointed out many sources of losses which might be avoided. As the greatest possibility of wasting or saving fuel lies in the boiler room, he says it is there that the practice of economy should begin. The boiler setting should be carefully examined for cracks or leaks which permit cold air to enter, since these not only reduce the draft, but the air cools the boiler as well. Leaks are more likely to be found around the breeching where it enters the stack, if it be a brick one, or if an iron one, around the bottom where it is set on the base or foundation; there may sometimes be found an opening an inch or more clear around where the mortar, cracked by the heat, has fallen out. Broken or warped grate bars are a source

of waste, because every time the fire is stirred a quantity of good coal drops into the ash pit and the loss in this manner would soon pay for new bars. Inasmuch as soot and scale are poor conductors of heat, their presence in the boiler should be carefully guarded against.

Steam traps and blow-off valves are apt to leak and are frequently neglected. If the steam from several boilers is blown into the same line an extra valve should be put on to use only when some of the others begin to leak. As this valve is used only occasionally it will remain tight for a long time. It is difficult to say which is responsible for the greatest amount of waste, a poor fireman or the poor condition of the boiler settings and accessories. A very efficient check on the firemen is a recording steam gage. This registers the steam pressure and is a silent and reliable witness and a ready reference, at any time. It is not only a check on the fireman, but on the engineer as well. In small plants where the fireman has duties other than firing to perform, a good damper regulator is an excellent adjunct, as it will keep the steam pressure with 2 or 3 lb. of constant. These devices are worth more to a small plant than to a large one, as in the latter the firemen are obliged to remain at the boilers all the time and so can regulate the draft by hand.

No positive rules for firing are given on account of differences in fuel, draft and methods of firing. Where the coal is hand-fired, the fires should be kept from 4 in. to 6 in. thick, the grates evenly covered and no holes or dead spots whatever allowed to exist. If run-of-mine is used, the large lumps should be broken to about 3 in. or under in size, as the fires can be run more evenly with small lumps. If the large lumps are used it is hardly possible to avoid having holes in the fires. Most of the coal should be stirred very little from the bottom, no matter if it does not look bright under the grates, if the fires are not kept too heavy there will be only a thin layer of ash on the grate, and this is not sufficient to retard the draft to any great extent. When a slice bar is used, it should be run on top of the grate, and the fire lifted a little but not pulled up clear through, because by doing so the clinkers are mixed through the coal, and in a short time it is so dirty that the fire cannot be cleaned without pulling it all out. When it is necessary to break up the fire on top a "devil's claw" should be used, and when doing this, oftentimes, clinkers can be pulled out.

Mr. Jennings emphasizes the fact that the fires must not be run too heavy, as with a light fire it can be cleaned as is necessary. Firemen coming on their watch, on the peak of the load, oftentimes pull out about half of the coal that the man on the previous watch had left in, and have a comparatively easy time keeping up steam. This was done in a plant where there were seven different firemen, and only two out of the seven could keep up steam on the peak of the load. The coal, if very fine and dry, should be sprinkled with water, as this prevents the fine particles from being carried up the chimney and helps it to coke. Water should be kept in the ash pit at all times. This not only keeps the grates cool, but burns the coal cleaner.

In looking for places to increase economy in the engine room one finds that while the engines are apparently running economically there are numerous leaks. The piston rings may be broken or badly worn, so that great quantities of steam leak by; the steam and exhaust valves improperly set, or worn and leaking badly. The matter of setting the valves is a mystery to some people. They think, as did the manager of a small plant for whom the author did some work, who, when told that the valves required setting, said that he could not see what difference that made, as all the steam that went into the engine had to come out again. That it did make a very decided difference this man found out after the changes were made.

Mr. Jennings told of being called upon to inspect a small lighting plant that had a 150-hp, high-speed engine and a 50-kw generator. The engine was built to run at 300 r.p.m. and was being run at about 210 r.p.m. After experimenting with the engine and not being able to improve the conditions without considerable expense, the owners were advised to buy a 100-hp, second-hand Corliss engine which was being replaced by a larger one. This they did, with the result that the coal consumption was cut nearly 40 per cent.

Oil filters should be properly looked after and cleaned and new filtering matter put in at frequent intervals. The pipes that are used for drawing off the water should never be connected directly with the sewer, as the person attending the filter is apt to start it running, leave it to do something else and forget it until considerable oil is lost. It is better to draw the water into a pail; this requires a little more time, but under average conditions is safer. A very successful device for saving oil and reclaiming waste or rags is the oil and waste saving machine. It is operated by steam on the same principle as the steam turbine, and one in use in Mobile, Ala., reclaims about 60 per cent of the wiping rags, and together with the oil, the saving amounts to about 60 cents a day, or $219 a year, so that the machine paid for itself in less than a year.

To obtain best results in a power house frequent tests are necessary. In making these a watermeter, draft gages and thermometer and a good platform scale should be available. The thermometer should be left in the boiler-feed line all the time and the draft gage used often. The coal must be analyzed and if the plant is a large one it would pay to buy a set of instruments for this purpose. It is assumed that watt-hour meters are used so that the total output of the stations can be obtained. In making these tests it is not necessary to employ a high-priced engineer. The regular station force can do the testing.

If the city water is used for the boilers, the water meter already on the line can be used to measure the water. If there is no meter a piece of pipe and valve should be placed in the bottom of an oil barrel, a 1-in. hole bored 2 in. or 3 in. from the top, the barrel placed on the scales and filled with water until it runs out this 1-in. hole at the top, then all that is necessary is to keep track of the number of barrels used and an accurate record of the amount of water evaporated may be thus obtained. Of course, this barrel must be placed over another connected to the pump. The coal and ashes must be weighed, and the superintendent or manager should watch the scales very closely, as it is quite easy to weigh a barrow full occasionally and guess at the rest.

By making a test occasionally a record to go by is secured and the engineer and firemen called to account. The best time and method for cutting in and out the engines and boilers can also be determined. It is undoubtedly cheaper to operate engines and boilers at an overload of 25 per cent or more for a short period than to cut in more units. Care must be taken, however, that these periods are not too long. It is the practice of some plants, where two or more boilers are fired during part of the day when the extra boilers are cut out of use, to have the valve open between the idle boiler and the steam main. This should not be done. If a condensing plant, using a closed heater, has a steam-driven vacuum pump it will pay to buy another heater, perhaps of a smaller size, and connect it in series with the main heater. By passing the feed water first through the main heater and then through the second or auxiliary heater, and using the exhaust from the steam pumps through this second heater, the temperature of the feed water will be raised very materially.

If city water is used on a meter, the meter should be read every day when the station meters are read. Then if the water consumption increases leaks should be looked for, and a place where a leak will sometimes occur is in the closed water heater. This can go on for a long time undiscovered unless checked by daily readings of the meter.

Coal and ash conveyors may perhaps be too expensive for the smaller plants, but oftentimes a light rail, narrow track or railroad may be installed cheaply and be a labor saver.

One does not hear any talk of waste in the office because the men are all educated and intelligent, men trained for their positions, and yet it is not uncommon for a manager to pick up the most ignorant man he can find for a fireman, turn over to him 200 or 300 tons of coal at a time, and virtually say to him, "Here, take this and fire it up the chimney as fast as you can, and when it is gone, tell me and I will get you more."

Investigation of the Heat Losses in an Electric Generating Station.

An inquiry originating from Blackburn, in 1903, showed that the average coal consumption of 34 principal generating stations of the United Kingdom was about 7.7 lb. per unit generated. The figures ranged from 3.6 to 15 lb., Blackburn standing at 10 lb. Rough tests on the various sections of the plant resulted in considerable rearrangement. The steam-pipe system was overhauled and more effectively drained, and steam separators and driers were in consequence dispensed with. Engine stop-valves were, where possible, attached directly to the main steam pipe. The steam ring was discarded, and generally the effective heat-radiating surface was greatly diminished. Better fitting boiler dampers were provided, the condition of the brickwork was improved, and the whole process of combustion was more thoroughly controlled by the institution of flue gas analysis. These and similar alterations occupied about three years, and the fuel consumption fell during that time to about 6 lb. of the same coal per average unit generated, a reduction of 40 per cent. Further progress being imperative, it was decided to conduct tests covering the whole operation of the works, viewing the losses peculiar to each part of the plant in their relationship to each other and to the whole, and arrangements were made, and apparatus devised, for their prosecution.

After isolated trials of the various types of apparatus had proved their reliability, simultaneous tests were arranged, of a duration long enough to embrace all conditions of operation met with in routine work. A very complete description of the tests was given in a paper by Mr. F. H. Carson, presented recently before the Institution of Civil Engineers, from which these notes have been taken, as showing the methods followed in a large British station to detect the various losses likely to occur in such a plant.

The Blackburn understanding comprises two adjoining stations of 2300 kw capacity each, containing 12 mechanically-fired Lancashire boilers, six fitted with superheaters; 15 high-speed engines driving generators from 60 to 775 kw in size, controlled from three switchboards; steam piping 3 in. to 13 in. in diameter; ejector and jet condensers fed from an overhead water tank above the boiler house; low-speed, steam-driven feed pumps; four batteries of economizers, totaling 1504 tubes; two chimneys, 150 ft. and 250 ft. high, respectively. The tests covered during 168 consecutive hours the combustion of about 230 tons of coal, the evaporation of 3.376 million pounds of water, and the generation of 99,295 kw-hours. The net results show a consumption of 5.15 lb. of coal, and a total evaporation of 33.9 lb. of water per average unit.

Observations have been taken half-hourly of the rate of evaporation, and of the temperature of the feed water at the feed tank and the economizer inlets and outlets; of the chemical composition and temperature of the gases in boiler and economizer flues; of the temperature and pressure of steam supplied to and discharged from the engines; of the temperature and quantity of the injection and discharge water of the condensers, and of the kw-hours generated. Some of these data have also been obtained by using recording apparatus.

The principal subdivisions into which the trials have fallen are: Fuel selection; estimation of moisture in coal; determination of calorific value; flue-gas analysis and measurement; evaporation of water and distribution of steam; steam consumption of auxiliaries; steam consumption of main engines, and measurement of output.

Fuel selection has been effected after comprehensive trials, involving calorimetric determinations and actual working test of various fuels. The calorimeter indication has been used only as a preliminary guide, supplemented by practical trial under working conditions. As a means also of ensuring uniformity of supply of fuel, the employment of the calorimeter has been largely discarded, more reliance being placed on observation of the coal in actual use. To exhibit the results quantitatively, the calorimetric determination of the heat value of the coal has been adopted.

Every load of coal entering the works is sampled at the weighbridge. All samples, roughly 1 lb. weight each, are mixed at the end of the day, and dried, the loss of weight being approximately a true statement of the moisture contained. Periodical tests have been applied to check the accuracy of the method, and have shown that some water, about 1 per cent of the weight of the sample, still remains. With this correction, the moisture can be estimated by these means with close approximation, and uncertainty as to the efficacy of the process is overshadowed by the doubt accompanying any calculation of the qualities of the whole from those of a smaller part.

In the determination of calorific value, the Thompson calorimeter has been modified for the removal of certain liabilities to inaccuracy existent in its original form. Oxygen supply from a gas cylinder has replaced that from potassium chlorate and nitrate, rendering combustion more controllable and securing better transference of heat to the water. Electric ignition has ensured thoroughness of combustion, and external silvering of the outer vessel has reduced radiation error. The mean calorific value from 73 tests of the dried fuel is 13,180 lb.-Fahr. units per pound, or, allowing for moisture, 12,310 lb.-Fahr. units per pound of the coal as fired.

The chemical constitution of the flue gases has been estimated by a Krell CO_2 recorder and by the Orsat apparatus. Considerable difficulty has been encountered in the selection of truly average sample gas, and a large number of tests have been made to ensure certainty of its representative character at all times. Numerous test holes have been drilled in the flues and samples from one point compared with those derived simultaneously from another. Other difficulties have arisen from the type of analyzer employed. After trial of varied arrangements, all such troubles appear to have been surmounted, and the correctness of results has been proved by confirmation of the Orsat apparatus.

Some doubt is suggested of the validity of computing the specific heat of the gases from that of their several constituents, and also of assuming the quantity to be independent of change in temperature and pressure. In the inquiry this course has been followed, any error resulting therefrom being probably exceeded by possible uncertainty of the chemical analysis. Four certified mercury pyrometers, one of the recording type, have been used for observations of temperature.

The fed water has been registered by a Siemens watermeter in the pump suction-pipe, the instrument being tested daily on the pumping, at various rates, of a measured quantity of about 2000 gal. Errors of the meter, due to the presence of air vessels, were encountered, but were obviated, and the half-hourly record of the meter, corrected by the error curves, may be accepted with confidence. The water lost by leakage and by blowing-down of boilers has been determinable by direct test, and the radiation loss by shutting off all engine valves and applying still tests of 10 hours' duration for the measurement of condensation. This may be inaccurate, for in practice the steam is superheated, but it has been preferred to results obtained from attempts to derive the figure from the fall in temperature accompanying the flow of a known weight of superheated steam.

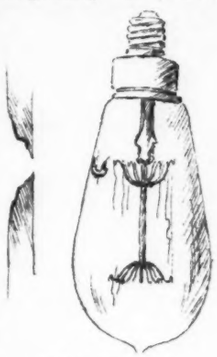
The tests for steam consumption of auxiliaries cover the steam used by furnace grate-jets, by feed pumps and by apparatus of domestic character. The first of these has been arrived at by feeding all jets from one boiler and noting the rate of evaporation; the second, by condensation of the exhaust into a known weight of water at various speeds of pumping, and the third, by frequent direct tests.

The steam consumed by the main engines is deduced from the increase in temperature of the condensing water, the quantity of which has been measured. The accuracy of this method rests upon dryness of the exhaust steam, which appears to be indicated by thermometers and mercury gages fitted to the engine exhaust. All electrical energy used for whatever purpose has passed through meters calibrated to 2 per cent accuracy.

LETTERS ON PRACTICAL SUBJECTS

PECULIAR ACCIDENT TO A TANTALUM LAMP.

The following account of a peculiar accident to an 80-watt tantalum lamp may be of interest to your readers. Coincident with a stroke of lightning, which blew the primary fuses, there was a loud explosion at the lamp and when service was restored the lamp failed to light. Upon examination, a crescent-shaped hole was found in the glass, which was evidently made from a force acting from the inside outward, as the hole was broken (not burned), while the sharp edges were broken away on the outside as shown in the sketch. The glass stem was broken away on each side at the parts where the platinum connecting wires are located. In the bulb were about enough pieces of glass to replace one of these broken portions, and the inference is that the piece of glass from the other side was shot away from the stem with such force that it passed through the bulb, making a clean hole with only a small crack on either side of it, as shown in the sketch.



DAMAGED LAMP.

NEW YORK. S. W. BORDEN.

DISMANTLING A LARGE STEAM ENGINE.

The task of tearing out a large steam engine is never an enviable one, but when the engine must be handled so that it may be erected again, the work becomes much more exacting. Care must be taken to remove each nut without straining the threads or springing the bolts. Every pin and key must be carefully removed and replaced either in its proper place or in some convenient packing box in such a manner that the article may be readily produced when the engine is to be reassembled. Sometimes everything goes well until the workmen arrive at the engine pulley. If this part is of the solid variety, and well keyed at that, the job sometimes gets the better of the man and the pulley goes out with the shaft and stays on the shaft until the engine is again set up. If the engine is a very large one, with a built-up pulley, it is impossible to leave the pulley on the shaft. In fact, the pulley itself must be taken to pieces, and here is where many a mechanic meets his Waterloo.

The several segments of which the pulley is composed are fastened together by means of links, dovetail anchors or similar articles. These links or anchors, whichever may have been used, have been put in place while hot and the contraction of the steel of which they are made has drawn the pulley segments very closely together, indeed. Likewise the bolts which clamp together the pulley hub have been screwed tight while hot, and the tightening which took place during the cooling of the steel bolts can only be understood by a man who has tried to remove these links or bolts. The bolts are comparatively easy to loosen, but not so the links. There is no way of getting under the links for they fill the cavities in the rim, in which they are imbedded. This, together with the fact that each link is pulling the rim sections together with a force of 15,000 lb. to 20,000 lb., gives an idea of what must be overcome in order to loosen each link or anchor from its hold upon the pulley-rim segments. Sometimes the mechanic drills some holes in each link and drives wedges in the holes until the links break. This removes the links, but new links must be made before the pulley can be reassembled. Frequently this is the quickest and cheapest way of getting the pulley segments apart, but when a man has taken a contract to dismantle the engine and reassemble it in its new position, he hates to break good, well-fitting links for the privilege of making and fitting new ones.

The writer has twice succeeded in loosening the links by building a charcoal fire against them as they remained in position in the pulley-rim. A plate-iron ledge was clamped to the pulley just below each link, and some loose bricks formed the semblance of a fire-pot around each link. Charcoal was piled into each fire-pot and ignited. When compressed air was available, some of it was piped into each pile of charcoal and the intense heat soon made the steel link hot enough to permit of its removal from its seat in the pulley-segments. When no compressed air was available, a smith's portable forge was placed convenient to the pulley and air was supplied to the fire-pots through lengths of garden hose which were in turn connected to the forge blower through steam pipes and fittings. When it is desirable to get along without even the portable forge, the charcoal may be made incandescent by means of a common blow-torch, such as is used by plumbers for heating coppers and by painters for removing old paint. One of these torches, blowing at full force into a pile of charcoal confined between fire-bricks or by some other adequate arrangement, soon stirs up a most intense fire and will bring quite large pieces of steel to white heat. But one link at a time can be heated with a gasoline blow-torch, while with an ordinary portable forge blower, three or four links can be heated at the same time by using 1-in. pipes for supplying air to each charcoal fire.

Once the links have been heated so they are loose it is an easy matter to pry them out with cold-chisels or pinch-bars; but this must be done very quickly, as also must the heating, for the efficiency of the method lies in heating the link before the segment gets hot. If the metal in the segment is allowed to expand as fast as does the metal in the link, then the latter can never be loosened by the method described. When links removed in this manner are to be replaced, it is well to upset them a little—heating them, of course, for that purpose, before they are again put in place.

Rim-segment links are not the only things which give trouble when dismantling an engine. Stud-bolts are the bane of the mechanic who follows that business. It should be the motto of every machinery designer never to put in a stud or a tap-bolt when a through-bolt can be used. That motto squarely lived up to will save a great deal of trouble to the erector, and to the operator of engines as well. It is a rule which the writer has conscientiously followed for many years, and it always works well.

To remove broken stud-bolts is hard; to break stud-bolts is easy. One will never believe a stud-bolt will break so very easily until he has tried it; and no one will believe that it is so hard to remove a broken stud-bolt until he has tried that also. It is so easy to believe both after one has worked all night at it. If a broken stud-bolt will not come out after a little work with a narrow cold-chisel and a hammer, then it is better to waste no more time on that object, except with a drill. It frequently happens that if a small hole is drilled axially into the stud that a square drift may be driven into the hole with sufficient force to allow the stud being backed out with a wrench applied to the square drift. Sometimes, however, this will not work; then it is better to follow with a larger drill and remove so much of the bolt or stud as will enable its being loosened and broken away without damage to the thread in the hole.

A left-handed drill will often be found of great value for removing broken studs. Soon a drill may exist in the twist variety, but I have never seen one. When a left-handed drill is required, it is usual to forge one of the old-fashioned flat kind, which can be ground either left-handed or right-handed at will. Drilling a hole down into a stud with a drill of this kind is almost sure to loosen the stud, whereupon the left-handed action of the drill causes the stud to unscrew and back out of the hole. One should not try to loosen a broken stud-bolt by heating it. Such action only results in tightening the bolt in its hole. The conditions are exactly opposite to what they were when the anchor links were to be removed.

WILLOUGHBY, OHIO. JAMES F. HOBART.

LOCATING GROUNDS ON UNDERGROUND LINES.

The following methods of locating grounds using only a telephone receiver, exploring coil and source of electricity have been used very successfully in practice by the writer on an underground transmission line where other methods failed. In Fig. 1 the source of electricity, which may be either alternating current or a direct current interrupted by a buzzer, is connected between one end of the line and ground, the other end of the line being left open. No good wire is required, and in this respect the method possesses an advantage over the loop tests, as a good wire is not always available.

The exploring coil is composed of a number of insulated copper wires, the ends being brought out to the terminals of the head telephone receiver. When the exploring coil is brought near a wire carrying alternating current or an interrupted current, a noise is heard in the telephone receiver caused by currents that are set up in the exploring coil by electromagnetic induction. To locate a ground, the exploring coil is passed along as close as possible to the faulty line, starting from where the line is connected to the source of electricity until a spot is reached where the sound in the telephone receiver starts to decrease, and perhaps 10 ft. or 15 ft. further on ceases altogether. The ground will be at the point where the sound starts to decrease. The writer located a number of grounds all within 3 ft. of the actual spot by this method on an underground transmission line about a mile long, the faulty wire being about 5 ft. underground. The exploring coil used was 2 ft. in diameter of circular shape and consisted of about 500 turns of No. 18 insulated copper wire. The wire was kept in place by insulating tape; the ends being brought out to the terminals of an ordinary telephone receiver of 100 ohms resistance. This receiver had a head-gear attachment and could have been fitted with two receivers, one for each ear for use in noisy places.

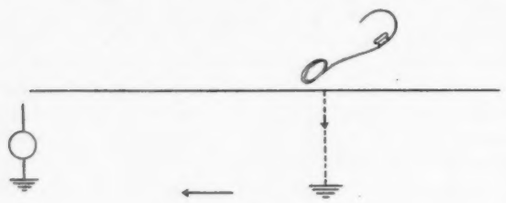


FIG. 1.—TESTING FOR FAULTS.

With this combination a 60-cycle alternating current as small as 1/10 amp in the faulty wire gave a sound in the telephone receiver when the exploring coil is 5 ft. away from the faulty wire. The sensitiveness could have been increased by using more turns on the exploring coil, but it was not necessay as the coil was amply sensitive. The maximum sensitiveness for a given weight of coil would, of course, be obtained when the impedance of the exploring coil equals the impedance of the telephone receiver.

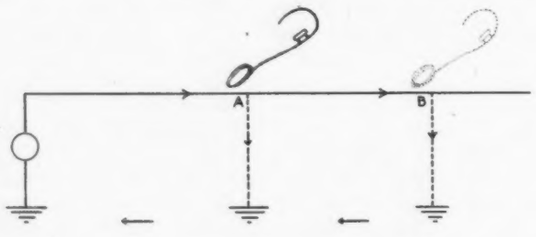


FIG. 2.—TEST FOR DOUBLE GROUND.

This method can be used when there is more than one ground on the line and the loop tests are useless. Fig. 2 shows a line with two grounds on it. In this case, when moving away from the source of electricity, the sound will decrease at the first ground *A* and will cease altogether at the second ground *B*, thus locating both. It is frequently impossible to locate a ground accurately by the Murray or Varley loop tests because of the low insulation resistance of the rest of the line caused by numerous high-resistance leaks to ground. This condition is met perfectly by the induction method of locating grounds as the currents due to these leaks are so small that they do not interfere with the accurate location of a serious ground. In Fig. 3 it is seen that there will still be a small current on the line after the ground is passed, if alternating current is used. This is caused by distributed capacity between the line and ground. These currents gradually get smaller as the end of the line farthest from the generator is reached. This phenomenon does not interfere with the location of the ground, as these currents are too small to be detected by the telephone receiver unless the line is very long and the voltage used is high. In case a high-resistance ground is encountered it may be broken down by applying a high voltage between the line and ground.

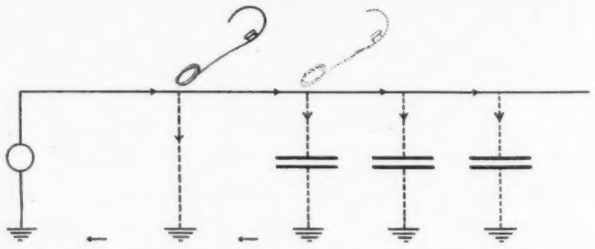


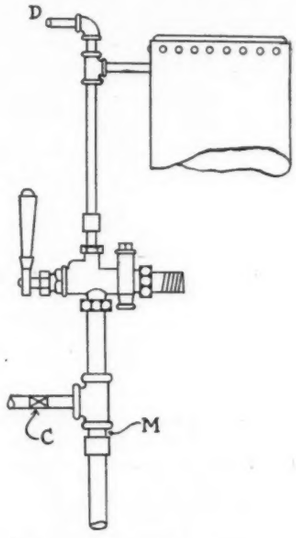
FIG. 3.—DISTRIBUTED CAPACITY BETWEEN LINE AND GROUND.

Philadelphia, Pa. Felix Wunsch.

CARE OF INJECTORS.

Injectors, like all other devices depending upon the same principles, must have the piping on the suction side air-tight or otherwise they will fail to work. Even when the piping is in good condition the injector may fail, due primarily to the way in which it is connected up or to its location. For instance, the writer has known an injector to fail to start because of the fact that it was placed too close to the side of the boiler. This condition is very likely to exist when injectors are placed alongside boilers of the locomotive type, the injector becoming hot. If the device is removed to some other point where the heat is not so intense it may be made to work. Many cases of failure on the part of the injector to lift is attributable to the fact that the pressure is not in proportion to the lift. The writer recently saw in a power house an injector with a 20-ft. lift which the engineer was trying to start with a steam pressure of 50 lb., without avail. When the steam pressure was increased to 85 lb. the injector operated. The majority of injectors will work about as follows: With water below 100 deg. Fahr. for a 2-ft. lift, a pressure of 25 lb. is required; for an 8-ft. lift, 30 lb. pressure; for a 14-ft. lift, 42 lb., and for a 20-ft. lift, 55 lb. For water having a temperature of 100 deg. Fahr. a pressure of 26 lb. would be required for the 2-ft. lift and 55 lb. for the 14-ft. lift. Injectors are like pumps in this respect, and do not lift hot water as readily as cold water. By having an inlet pipe in the suction and a regulating valve as shown at *C*, hot water may be handled by the injector. In this case just sufficient cold water is permitted to flow to the injector to cool it by the aid of this valve. When working an injector from city water mains or from other water mains under pressure, a regulating valve should be placed in the supply pipe so that the flow of water may be controlled. Injector troubles may be due to too much head or again by too small a supply pipe. In the latter case the injectors will kick back. Another cause for an injector losing its suction is due to a steam pipe connection leading to the pipe that supplies the injector as shown at *D*. When the latter valve is open the vacuum will be lost, and unless the supply pipe is quite large it is best not to have any pipes leading from it since the opening will cause trouble. Steam should always be taken from the dome or from the highest point in the boiler so as to insure dryness. Very frequently small leaks in the suction pipe, as shown at *M*, cause trouble, and these can

be tested by pouring on a little oil while the injector is working or trying to start. Oftentimes failures are due to the strainer being stopped up. Small particles will accumulate until not sufficient water can pass through. Wet steam also causes trouble at times in the working of injectors. If it is possible to raise the water and yet not force it into the boiler, this is a good indication of a leak in the suction pipe, wet steam, or insufficient steam pressure, or the drive tube on the interior of the injector may be stopped up. When steam and hot water issue from the overflow it is an indication that the steam pressure is too high for the lift, or the water too hot, and in



INJECTOR CONNECTIONS.

some instances it may indicate that the suction pipe is clogged. Water that carries much lime in solution will coat the injector so that it will be necessary to clean it frequently. This can be done by taking the parts out and and immersing them in a liquid consisting of 12 parts water to 1 of muriatic acid until the lime is removed. A leaky check valve letting hot water back upon the injector will sometimes prevent the latter from working. The working conditions of the injector will vary, and an injector to suit exact conditions can be had by specifying these to the manufacturer.

LYNCHBURG, VA. C. R. MCGAHEY.

LINE WORK FOR A SMALL LIGHT AND POWER PLANT.

The engineer in a small light and power plant is very often called upon to perform various duties, and generally is required to be the meter man, arc-lamp trimmer, the running engineer for a few hours each day and to look after the inside wiring, as well as to keep his machinery in running order. In fact, he has the supervision of the plant under his control, and all new construction comes under his care and he is required to see that it is properly executed. For the engineer who is called upon to do outside construction and who is not familiar with this class of construction, the following may be of service. Most generally in small plants the direct-current system is used, the best reason being that there is very little territory to cover and the fact that direct current will answer the purpose just as well as the alternating-current system in a small town of a few hundred people.

The outside work generally receives the least amount of attention, while, in fact, it should get the same attention that any other part gets and in some cases it should receive the most, for the failure of several plants can be traced directly to bad construction of lines which, of course, prevents good service, besides the cost of keeping them up. Any one that ever did a job of line work will know that unless poles are properly set and guyed they are not going to give much satisfaction. As an example, the writer will consider one mile of No. 0000 solid and insulated wire to be strung on a straight lead by the engineer with the necessary help. The poles selected for this class of work should be about 30 ft. high, with tops about 6 in. or 7 in., and if the poles are bought from some reliable firm they will come very near to specifications and they will be the right taper, which will give them the right size at butts. The poles should be as straight as possible and none of them should have more than two "bellies," that is, sweeps, and should be free from rotten places such as in the tops and butts. They should also be as free from knots as possible and no poles should be accepted that are split at the top. The latter might be used as guy stubs and anchors, but they will not be the right height, for a pole after the split end is sawed off and while there may be a few places that short poles can be used it is not advisable to figure on very many of the short ones.

The cross-arms are next selected and the requirements are for two wires, but there may be in the future demands for another pair of wires and as the cost of using a four-pin arm is not very much more than the two-pin arm it would be advisable to buy the four-pin arm as the cost of taking off the two-pin arm and putting on the four-pin arm would amount to quite a little sum. The arms should be of yellow pine and standard, which would be about 4 ft. long, bored for one 5/8-in. through bolt and for two 3/8-in. carriage bolts and for four 1½-in. pins. The arms are generally painted with one coat of red paint and are ready for use as soon as they arrive on the ground. The pins should be of split locust, and before being used they should be dipped in paint, or gas tar, which prevents moisture from getting in the cross-arms and lengthens the life of the pin and arm.

When the work of digging the holes is begun, the engineer will have to use his judgment to a certain extent, as he will meet with obstacles that would not be met with elsewhere. The holes should be dug large enough to accommodate the butt of the pole without any cutting of the pole and besides it will save time in the long run. The poles should be delivered to the holes and framed, and the arms should be placed in the gaines on the pole before the pole is raised. It is better to put the arms on at the holes than at the yard because the arm will be dragged off as the poles are delivered to the holes.

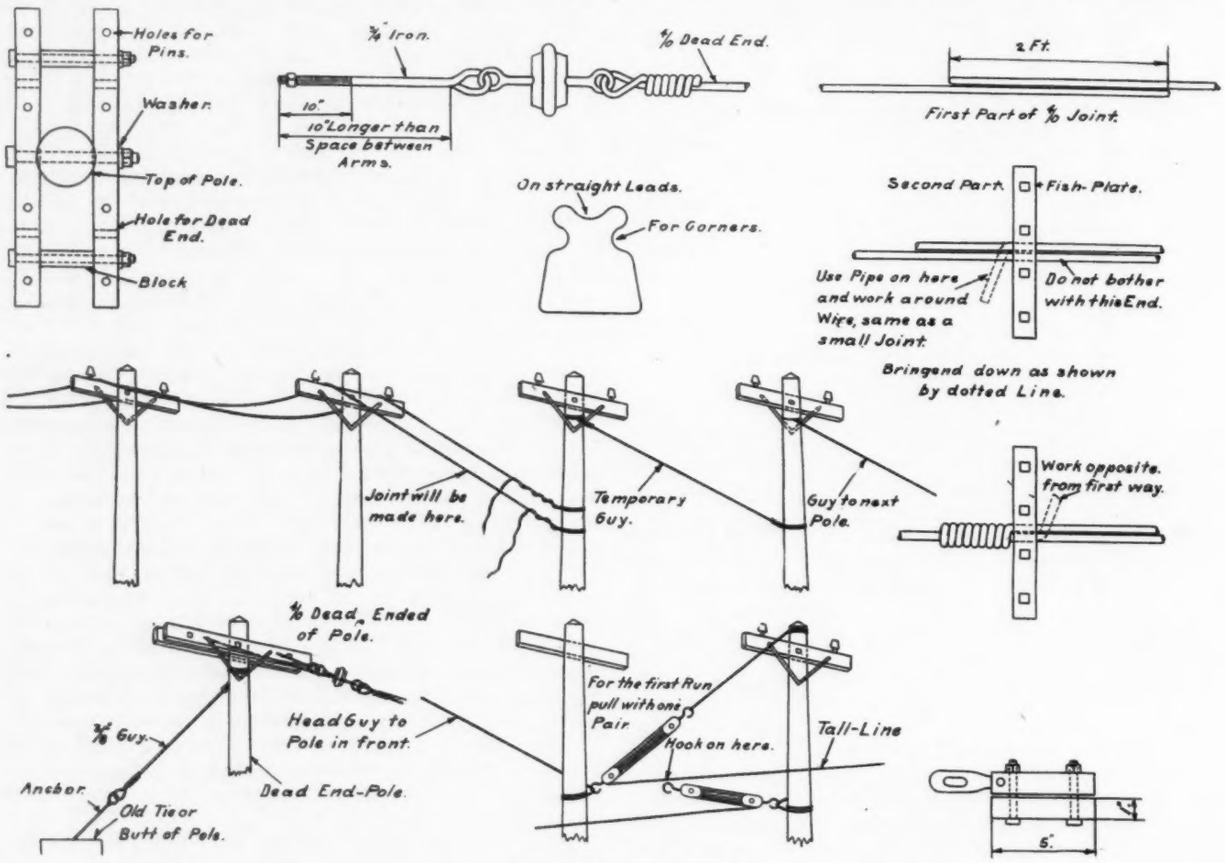
The best practice in raising poles is to let the men dig one-half the day and raise poles the other half, as the change of work rests the men. Besides, there will be no holes open over night for someone to fall into and bring suit against the company for damages. Should it happen to rain during the night the holes would fill up with water and this would require bailing out, as the poles could never be tamped in with mud and water, and this, of course, would mean an additional expense. The holes should be at least 5 ft. deep on a straight lead, but on the two dead-end poles, the holes should be 6 ft. deep, the poles well guyed, as all the strain is on these two poles, and they should also be the heaviest.

The poles should be well tamped, as here is where the important part of setting poles comes in. The usual way to tamp a pole is for one to shovel and three to tamp, the dirt being thrown in very slowly in order to let the tampers do the proper work. After the pole is tamped to the level of the ground, the dirt should be piled up around the pole to allow for settling. When the poles are set, the arms on one pole should be made to face the arm on the next, the reason for this being that if the wire should break, the strain on the arm would be against the pole instead of the bolt and washer.

The poles on a straight lead can be set plumb, but on corners and for dead-end poles, the pole should be given a small amount of rake or, as it is better known, slant, and when the wire is pulled up the pole will just about straighten up and be plum. As these are two dead-end poles on this lead it will be necessary to give these rake as well as to guy them with 3/8-in. seven-strand guy wire. The two dead-end poles should be double-armed, as shown, and two holes bored about 6 in. from the end of each arm to accommodate a dead-end bolt for each wire. These are shown in the drawing and can be made at a blacksmith shop. The line-strain insulator can be bought

from any supply house and four of them will be required for this job. They should be the ones with the large eyes so as to accommodate No. 0000 wire.

After the poles are all up, the wire is now ready to be strung and a running line of about 500 ft. of ½-in. rope will be required, together with two pairs of blocks and tackle, some rope slings and a clamp for holding the wire when it is pulled up. This can be made at the shop, and the illustration shows a clamp as it would look and the method of fastening it to the wire. The reel is first put on horses or blocks so as to allow it to turn freely and a few feet of wire run off. The running line is fastened to this end and the wire is started toward the other end of the line, or the other dead-end pole, as the reel is at one dead-end pole when the stringing is begun. The wire is placed on the cross-arm and the line is taken to the next pole and passed over the arm as in the first place, and this is kept up until the rope is all played out. The wire is then ready for the first pull, which is accomplished by hitching a horse or mule



DETAILS OF LINE WORK.

onto the end of the rope and pulling the wire up to where the rope leaves the last pole or where it comes from the last arm to the ground. The rope is then pulled back for another run and the wire is pulled up as in the first case. This method is repeated until the line is completed, and the other wire strung on the opposite side of the arm as the first.

After the second wire is run out the slack is ready to be pulled up and this is accomplished by means of the blocks and tackle. Before the wire is pulled, the two poles where the wires run out must be head guyed as there will be some strain on them, and ¼-in. guy wire is used for this purpose. The method of guying the poles is shown in the lower left-hand part of the illustration.

The ends of the wire should first be dead-ended in the eye-bolts as shown, and then the wire is pulled up as tight as possible on the first pull with one pair of blocks. After the wire is as tight as one pair will pull, the second pair of blocks can be hooked into the fall line of the first pair and the wire pulled as tight as is necessary. The end of the wire is taken to one of the poles that was guyed and dead-ended around the pole, and after this one is secured the other wire is pulled up and dead-ended in the same manner.

This part may then be tied in with about No. 2 wire if a deep-groove, double-petticoat glass is used and if the mule-ear type of insulator is used a No. 12 wire can be used. The latter type of glass is really the best, as the wire lies in grooves and is held more rigidly than with the other glass.

The other reels are now placed and the wire is run out as in the first case, but before the wire is pulled up two joints have to be made. The method of doing this is shown at the right of the engraving, and all the tools necessary for this are two fishplates, a piece of 1-in. pipe about 4 ft. long, a blow torch and the soldering tools. The neck of the joint should be made to come up closely so as to make a neat as well as a mechanical joint, and after the joint is made it should be soldered and taped and the tape painted with a coat of weather-proof paint. The other joint is made in the same maner as the first and the wire is ready to be pulled up from the other end of the line. This is accomplished in the same manner as in the first case, and the wire is deadened around the dead-end pole and tied in just as the other wire was. The wire is now ready to be made up in the dead-end bolts and this is not as easy a job as the first was because these have to be made upon the pole while the others were made up on the ground. Before the wire is loosened from the dead-end pole, a sling should be tied on the top of the pole in front of the dead-end pole and fastened to the wires to hold them from putting all the strain on the ties. This sling can be taken off as soon as the wire is made up on the pole. The method of deadending is shown as well as the use of the blocks on the pole and the method of guying. The two end pins should be used on the cross-arms, as it will throw equal strain on each end of the arm, besides permitting the lineman to get up between the wires more easily.

Charleston, W. Va. C. R. Strother.

QUESTIONS AND ANSWERS

How can leather belts be freed from oil?

Immerse the belt in naphtha for about 24 hours and then treat it when dry with a tanner's dressing.

How should the neutral of high-potential alternators be grounded? E. N.

The proper method of grounding the neutral of high-potential alternators is through a low ground resistance of possibly not more than 2 ohms. In this manner the maximum potential that can be obtained between the system and ground is fixed at the normal potential that will exist between the neutral of the generator and its phase terminal. Grounding in this manner has met with success in practice in a number of large cities.

Will you please inform me how the enamel used by the makers of electric heating apparatus is made? W. B. M.

The ingredients used by the various manufacturers of electrical heating apparatus for enamel are necessarily secret. A simple mixture suitable for the purpose may be made up, however, of the following: 30 parts natural borate of calcium, 20 parts fluoride of sodium and aluminum and 50 parts feldspar. The coefficient of dilation of this mixture is stated to be 0.00001055, and as the coefficients of expansion of platinum, iron and nickel fall within the limits of this figure, these metals may be used in connection with this enamel.

We are operating an alternating-current, three-phase system having both lamps and motors on the same circuits. Until recently no trouble was experienced with the lamps; but lately the regulation has been very poor. Would balancing the phases remedy the defect? R. A.

The practice common among small stations operating under somewhat similar conditions, is to control the voltage on the single phase to which the lamps are attached by an automatic potential regulator and pay no attention whatever to the potential of the other phases. The motors operating on the circuit will draw the most of their load from the other phases and although the voltage of the three motor legs varies, no bad effects are encountered.

In changing over from natural to artificial gas, and vice versa, what provisions are necessary in order to use either under a boiler? E. P. E.

Natural gas being almost entirely composed of methane or marsh gas, requires much more air to effect its complete combustion than artificial gas. Methane requires two times its volume of oxygen, whereas hydrogen and carbon monoxide, the chief constituents of artificial gas, require only half their volume of oxygen to effect complete combustion. The orifices of appliances burning natural gas are smaller than those burning artificial gas because natural gas is ordinarily carried at a higher pressure. Roughly, about four times as much air is necessary to effect the complete combustion of natural gas as is necessary completely to consume artificial gas.

We have a 50-hp direct-current motor connected to a line shaft from which are run a number of emery wheels. The motor is built for 220 volts and takes 180 amp with the controller on the first notch. This suffices to start the emery wheels; but when full speed is reached only 60 amp is required. What type of induction motor is best suited for this work, the supply being 220 volt, three-phase? Can a large motor of the squirrel-cage type rated at 50 hp, even if it were not connected to a line shaft, be started without an auto-starter? E. N. N.

In order to duplicate the work of the 50-hp, direct-current motor driving emery wheels, it would be well to install a 40-hp induction motor, preferably of the wound-rotor type, although a machine of the squirrel-cage type could be used. In starting up a 40-hp, squirrel-cage induction motor from rest, it is very desirable to employ either an auto-starter or a resistance-type starter. With almost no exception motors of this size are never started from rest by being connected directly across the supply circuit.

Can you suggest some quick means for determining whether lamps returned by customers are still suitable for service? H. H. C.

The proper and best way to judge returned lamps is to install a photometer and to test each lamp, classifying it according to its candle-power. For all practical purposes, however, good results may be obtained by mounting a series of lamps with different degrees of blackening on a white background. Under the series may be placed the measured candle-power of each lamp. The blackening of any lamp may then be quickly determined by locating it in this series which serves as a standard. It has been found that the degree of blackening constitutes a reliable criterion for the depreciation of the lamp. By this means one can readily determine whether the lamps have been returned too early or too late in their lives, and also whether the lamps are much below rating.

We have a 30-kw, 250-volt, 725 r.p.m. direct-current generator, belt-driven by a four-valve, center-crank, automatic engine running at 220 r.p.m. on 115 lb. steam pressure. The dynamo is about 15 ft. from the engine and is driven by a good double belt. The trouble is that there is a decided flickering in the light from this dynamo which seems to be in synchronism with the speed of the engine. We have driven the generator by motor and it then gives a steady light. We have also disconnected the engine and belted the dynamo to one of the fly-wheels so as to run the engine crank shaft and drive the dynamo by its regular drive belt. Under this condition the lamps show no flickering. What could you suggest as to remedying the trouble? A. E. Co.

From the information given there can be no doubt that the flickering of the light is caused by a variation in the rotative speed of the engine. The only method of overcoming the flickering is that which will prevent fluctuation in the speed of the engine. It is probable that the use of a heavy flywheel in connection with the set will minimize the flickering to a satisfactory extent.

What precautions are taken by companies connected to transmission lines to keep down the peaks, where the practice is to penalize on peaks? B. C.

Most of the transmission companies sell electrical energy in blocks of so many horse-power per year, the customer agreeing to pay for energy taken above the maximum at a certain increased rate based upon the highest peak. It is possible to have a motor-generator set with an automatic slip regulator of such a nature as to keep the load taken by the set from the transmission line a constant. Some companies employ steam-driven apparatus, which is cut-in on peak loads. Others feeding railway loads employ rotary converters with a special arrangement of potential regulator and contact-making ammeter so adjusted that a constant load is kept on the machine, other machinery taking the peaks so as to get rid of the peak charge. The device used consists of an ammeter with relays on either side, which control the regulator circuit. A large motor is placed on the regulator so that quick operation of the latter will result.

We are contemplating the installation of a storage battery and wish to know how best to insulate this from the floor. T. A. L.

There are various methods of installing storage batteries, any one of which answers the purpose well. A good job can be made with a double tier of porcelain insulators. The first tier may be mounted on brick piers which are capped with a hard-pressed tile thoroughly impregnated by boiling in paraffin. Triple-petticoat porcelain insulators are then placed on the tile. Longitudinally with the cell and resting on the four insulators are placed two hard-pine sticks, 4 in. x 4 in. x ¾ in., well painted with an acid-proof paint. On each of these hard-pine sticks are placed three tiles boiled in paraffin, and resting on these tiles is a second tier of porcelain insulators, which in turn supports the battery tanks. The distance from the floor to the bottom of the tank in a case such as cited will be about 20¾ in. The floor under each cell should be pitched away from the cells at an angle of about 20 deg. This will allow any surface water or dripping from the tank to drain off rapidly. Frequent washings of the floor immediately under the tanks and systematic cleaning of the insulators will prevent leakage. The floor should be of glazed tile or vitrified brick with asphalt joints. Cement is attacked by sulphuric acid.

CENTRAL STATION

MANAGEMENT, POLICIES AND COMMERCIAL METHODS

The Moonlight Schedule in Old Paris.

The first attempt at street lighting in Paris at municipal expense was made in 1667 when the Parliament authorized the installation of 3000 lanterns in streets most notorious for night hold-ups, the source of light being the tallow candles. This introduction of systematic street lighting was commemorated by the issue of a medal stamped with the legend in Latin, "Security and Light." In 1745 the candles in lanterns began to be displaced by oil-burners, with which tin reflectors were used, but this improvement was for some years confined to the more prominent streets. In order to reduce the cost of this more expensive service, the contractors for oil lighting were later given the privilege of a moonlight schedule, which proceeding became the subject of much ridicule and was so lampooned from the stage and by writers of satirical verse that finally, about 1774, all-night lighting was restored. It is scarcely in accord with up-to-date American methods that the moonlight schedule should be largely used in this country after being laughed out of Paris more than a century ago, in a period of the most primitive ideas with respect to street lighting.

Discussion on Tungsten Lamps at Northwestern Electrical Convention.

Following the reading of a paper on "The Commercial Development of the Tungsten Lamp," by Mr. S. E. Doane, chief engineer of the National Electric Lamp Association, at the Northwestern Electrical Association convention, at Milwaukee, Jan. 20 and 21, Mr. H. C. Sterling, of New London, Wis., inquired as to the changes which had been made in manufacture to permit the lamp to be used in other than a vertical position, as specified for the early lamp. Mr. Doane replied that there was no reason why any tungsten lamp should not be burned in a horizontal or angular position if it was properly made. In the early lamps considerable allowance had to be made for shrinkage of the filament, with the result that the filament was hung loose from the upper support. The difficulty with the shrinkage having been overcome, the filaments are now mounted without slack, and are stretched between the supports. In answer to a question, he told of a new 4-cp, 5-watt sign lamp which had just been brought out to operate on 10-volt circuits, in connection with a small 10-volt transformer mounted on or near each sign.

Mr. F. W. Willcox called attention to a 40-watt tungsten lamp in a small bulb which has recently been brought out. This is intended to go in the regular sockets and reflectors used with 16-cp lamps.

Mr. J. H. Harding, of La Porte, Ind., reported having made a number of tungsten installations. He had been very careful as to how these were put in, seeing that they were placed on proper fixtures with efficient glassware. His experience thus far had not been satisfactory with lamps installed in other than a vertical position. On the whole, the result of these tungsten installations had been an increase in revenue. He sells tungsten renewals to consumers at the price they cost the company.

Mr. Ludwig Kemper, of Albert Lea, Minn., said that at first he made a few installations in which the consumers paid a fixed rental and maintenance charge. This was before the lamps were understood, and when the consumers were suspicious of the lamp. Now he sells these lamps at a profit. He does not sell the 25-watt size, as he is afraid of excessive breakages due to the fact that in so many cases they will be used where there is no wall switch.

Mr. O. M. Rau reported that at Milwaukee the practice had been adopted of furnishing tungsten lamps to consumers who would otherwise receive free renewals of carbon lamps, on the basis of 15 cents less than the list price of the tungsten lamp. This 15 cents credit is allowed the consumer because he does not require a carbon lamp renewal where he is using a tungsten lamp.

Mr. Doane expressed the opinion that the carbon lamp would be with us for some time. The output of carbon lamps during the past year, in spite of the tungsten output, was equal to that of the boom year 1906. The carbon lamp would doubtless continue to be used in the numerous sockets where lamps were infrequently used, and where economy was no great object, as well as in cases where breakage would be likely.

Mr. Rau spoke of a large tungsten installation in Milwaukee in which a great reduction in revenue to the company had resulted. He, therefore, felt it necessary to make a vigorous new-business campaign to get tungsten lamps in the places heretofore using gasoline or gas in order to make up for the loss of revenue on some of these existing installations.

Mr. J. G. Boyd expressed the opinion that it was a reflection on the selling ability of a central-station man if consumers were quietly being allowed to substitute lower wattage tungsten lamps for carbon lamps heretofore used. If the central-station man exercised proper diplomacy and salesmanship the light would be increased and the wattage would not be reduced.

Mr. Doane cited the case of a progressive combination gas and electric company which recently found that by the introduction of tungsten lamps its revenue from store lighting installations and the like had been reduced, but the total gross revenue had been increased because of the sign and window lighting which had been taken on as the result of reduction in store-lighting expense.

Mr. C. H. Williams, of Denver, reported that his company (Northern Colorado Power Company) was putting out tungstens on a flat rental basis, plus the regular kw-hour charge. This schedule of rental and maintenance per lamp is as follows: 40-watt, 20 cents per month; 60-watt, 30 cents; 100-watt, 60 cents; 250-watt, $1.50. He did not believe in waiting for the contractor to put in tungsten lamps and cut the company's revenue by reducing the wattage. He further expressed the opinion that the tungsten was the best tool that the central-station company ever had in replacing gasoline plants.

Mr. George Loring talked to the effect that the central station could, if it wished, keep the friendship of the dealers and contractors and get them to talk increased illumination rather than reduced bills.

Central-Station Power Loads in Great Britain.

The current issue of the London *Electrician* contains an elaborate table giving statistics of the power load of 70 British central stations. The data are given under the heads of the trades to which power is supplied, voltage, horse-power connected, total number of motors, largest motor on circuit, maximum demand in kilowatts, method of driving, rates horse-power of steam and gas engines displaced, and the number of isolated power plants at present operating. Glasgow heads the list with a total of 27,000 hp of moters. The Clyde-Valley Power Company makes a return of 14,200 hp on motors connected, and the New Castle & District Company has a total of nearly 9000 hp. The Cork central station has already displaced 1000 hp of a total of 3000 hp of isolated power plant in its territory, and the North Wales Power Company, with a total of 5000 hp connected, has displaced over 3000 hp in engines. The Bradford Corporation has 1478 motors connected, largely in textile and dye works. The Birmingham Corporation supplies 1740 motors employed in the metal, cycle and jewelry trades. Among the

London central stations that of St. Marylebone supplies 474 motors in printing offices, small workshops, etc., displacing 3374 kw of other power, and the Metropolitan Electrical Supply Company supplies 897 motors in ordinary workshops. The enterprising West Ham station has 500 motors connected, which have displaced 4500 kw of other power.

The motor rates vary considerably, ranging from 6 cents per kw-hour to 2 cents per kw-hour, and even less in a few cases. In Glasgow the rate varies from 3 cents to 1½ cents per kw-hour, with a flat rate of 2 cents for restricted hours. In Dublin, where 2000 hp has been displaced by motors, the rate is 2.75 cents per kw-hour. The data relating to the number of isolated power plants at present operating is interesting. In the territory of the Luton corporation, for example, there are 300 gas engines and 250 steam engines. In this territory there are 268 electric motors now supplied. In Reading there are 175 gas engines and here 256 electric motors have been installed.

It is interesting to note that the best showings are made by municipal plants, many of which have vigorously conducted "new-business" departments.

Non-Peak Load at Lincoln, Neb.

Various statements have been published from time to time regarding a remarkable improvement in load factor by the Lincoln (Neb.) Gas & Electric Light Company, due to the securing of load for non-peak periods. The sign and outline

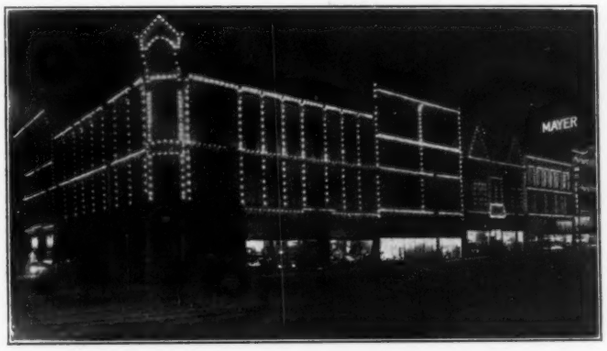


FIG. 1.—OUTLINE LIGHTING AT LINCOLN, NEB.

lighting which this company supplies was one of the principal causes of improvement. It will be interesting to note some of the recent business which this company has secured which will have a tendency to smooth out the load factor still fur-

FIG. 2.—OUTLINE LIGHTING AT LINCOLN, NEB.

ther and improve the earning capacity per kilowatt of station apparatus installed.

One large contract for outlining the department store of Rudge & Gunzel, amounting to 30 kw, was recently closed with the agreement that lamps are to be turned on after 6 p. m. only. This brings them off the company's December peak. The com

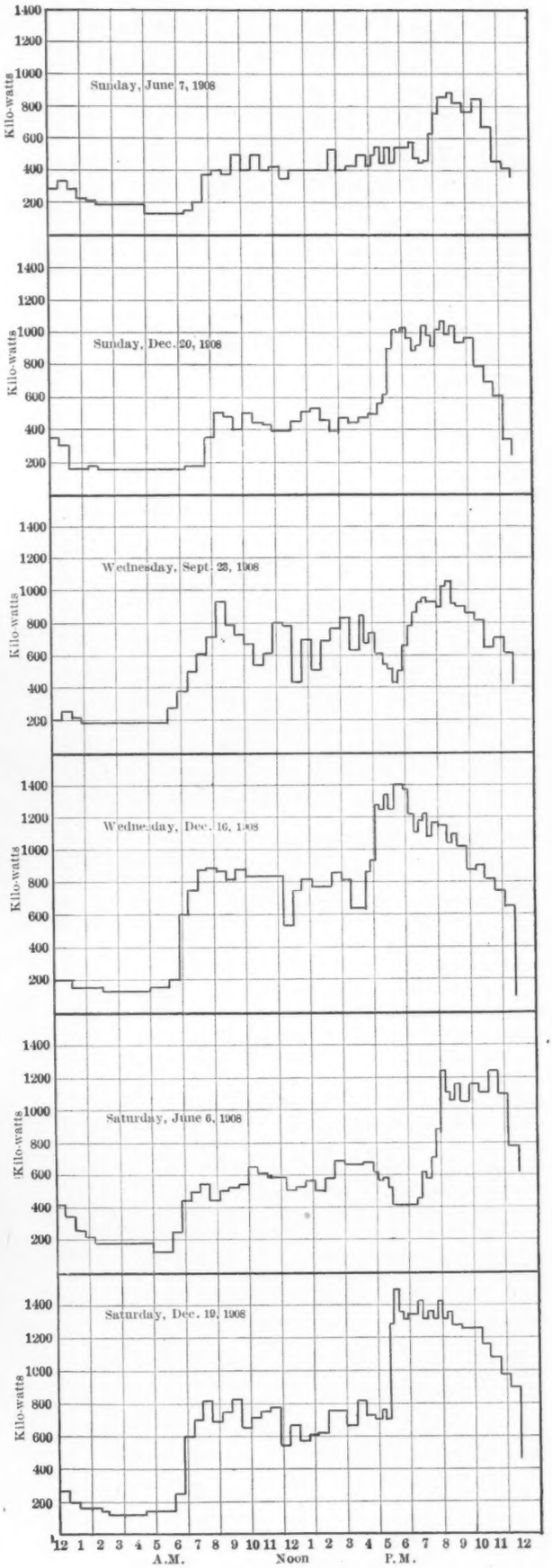


FIG. 3.—TYPICAL DAILY LOAD CURVES.

pany also has an 85-hp load in a factory which it has taken under a contract whereby it can ask the factory to shut down at 5 p. m. Another excellent non-peak contract is with an ice cream manufacturing company which uses 40 hp, 24 hours per day, in the summer. In the winter it will shut down during the peak load.

The principal hotel in town, which has its own isolated plant, uses central-station service from midnight until dusk the following day, paying $100 minimum bill for this service. This is cheaper than operating its isolated plant for such light load. The city hall has been taken on a similar contract, as the municipal street lighting plant which supplies the city hall does not operate during the daytime. In the case of the city hall, however, there is no minimum guarantee, as the ordinary daylight consumption is sufficient to reimburse the company for its outlay.

The output of the station in September, 1908, was as follows:

Power sold to street railway, 90,000 kw-hours.

Direct-current commercial power, 62,000 kw-hours.

Alternating-current commercial power, 30,000 kw-hours.

Alternating-current lighting, 126,000 kw-hours.

Fig. 3 shows the typical daily load curves for different days of the week at different seasons, and indicates the considerable amount of non-peak business the company carries.

The station capacity is 1400 kw alternating-current, and 500 kw direct-current. The latest unit is a 500-kw Westinghouse-Parsons turbine. This turbine is run condensing with power obtained from a cooling tower. The cost of this cooling tower was about $3 per kilowatt. It is 30 ft. high by 10 ft. x 30 ft. It is found that the make-up water required for cooling purposes to compensate for evaporation is about equal to the steam condensed. The performance of this turbine before the condenser was in operation was about 5.7 lb. of coal per kw-hour.

Commercial Department of the Rochester Railway & Light Company.

By William H. Stuart.

With the consolidation of all the lighting interests in 1905, the Rochester Railway & Light Company started a new-business department, employing one solicitor on lighting and one solicitor on motor installations. In October, 1906, the company organized a commercial department to secure, in addition to new business, the good-will and interest of the public. This department is in charge of Mr. F. A. Willard, commercial agent, who has under him seven solicitors. One looks after special heating appliances, two solicit lighting business, three devote their time to motor installations, and one seeks to introduce electric signs. The men are not limited as to territory and make a report of each day's work. In order to secure as much business as possible among the farmers in the district north of the city, one solicitor devotes all his time to them introducing motor-driven pumps for irrigation purposes. Within two years work in this territory has resulted in the installation of about 400 hp in motors. These have replaced windmills and gasoline and steam engines. The company expects shortly to install three separate model pumping installations for this work, each rated at 20 hp. A motor installation which has given very satisfactory service consists of a 150-hp, direct-current motor direct-connected to a turbine pump. The installation is used for pumping water from the Genesee to a large reservoir 120 ft. above the river. The water is used by a local brewery and the motor is controlled by an automatic switch. The greater part of the lighting load comes from residences, stores, signs and outline lighting work. Since its formation, the commercial department has increased the load on the company's system 45 per cent.

One important feature of the commercial department is the method of handling complaints. From the start the company abolished the idea of having the word "complaint" appear in the office, as it felt that the word in itself was a misnomer, in that persons who came to have any matters adjusted were led to believe that the company was going to be harsh and strict. Such a sign also deterred customers from making any suggestions for betterments because they did not care to go to a complaint desk. So the company established an "Information Bureau," where one can tell of his trouble and go away feeling that matters will be satisfactorily adjusted. The men at this desk are supplied with a pad on which are noted the name and

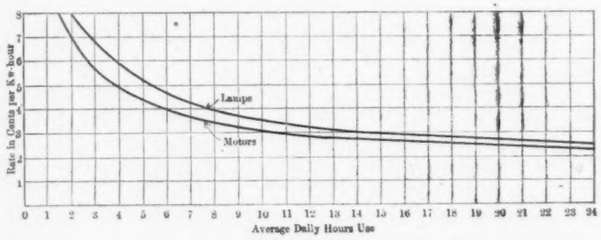


FIG. 1.—ENERGY RATE CURVES FOR LAMPS AND MOTORS.

address of the customer and the nature of the trouble. If the matter necessitates attention from an employee of the company, an order is issued in duplicate and an investigation made. When the difficulty has been adjusted the order is returned to the man who issued it, where it is checked with the original slip and a letter is sent to the original party stating that on such and such a date the company issued an order to investigate the trouble and that the matter had been reported as being adjusted satisfactorily. This letter is sent out by the commercial agent, but no reply card or envelope is sent with it. If the trouble has not been adjusted it will naturally bring forth a letter addressed to the commercial agent. The company is thus certain that every complaint is properly and satisfactorily attended to, and by this means has accumulated a great number of unsolicited replies of which it is quite proud.

The offices of the company are located at 44 Clinton Avenue, North, in a building three stories high, faced with terra-cotta brick. On the main floor is located the bookkeeping, cashier, information, commercial, canvassers and sales departments. On the upper floors are located the executive and engineering offices of the company. The show windows on the street floor are very large and contain an exhibit of either gas

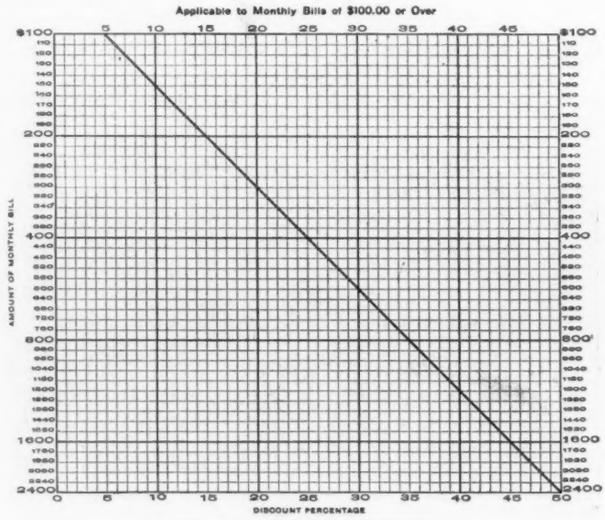


FIG. 2.—DISCOUNT SCHEDULE.

or electric appliances. Sometimes a set display is placed in one of them showing how a storekeeper could dress a window and have it illuminated by electricity. The principal use of the windows is to show the shopkeepers how best to arrange window illumination and what the result of good methods will be. Back of the windows within the office space there is considerable show space allotted to heavy gas and electric appliances. To

the rear are the bookkeeping, information and commercial department offices. On the left-hand side of the office is a stairway leading to the basement, where there is an exhibit of a model apartment. In the four rooms are placed numerous domestic appliances operated by electricity. All the various devices are connected so that a demonstration of them can be quickly and easily made. The apparatus range from an electric piano in the parlor to a washing machine in the laundry. On the main floor is a large sign calling attention to the exhibit. The sign reads, "Do not fail to visit the House Electrical before you go." The company contemplates rearranging this basement space so as to show motors and appliances in operation. At present the various advantages of electric service are pointed out from catalogs and photographs. This general electrical exhibit is looked after by a saleswoman and a salesman, who are in constant attendance. The "House Electrical" has created considerable talk and favorable comment throughout the city. The company believes it has been a great help in the work of introducing electric service.

The company has put out a great many flatirons and a number of the consumers have two or three irons in use. The company found, at first, that a great many irons were returned because their working was not thoroughly understood, and now a solicitor delivers the iron and explains its use. The solicitor also examines the circuits to which the iron is to be connected to see if they are large enough. In this way irons sent out on trial have been retained by the consumer, and the introduction of this home appliance has been greatly facilitated.

The company confines its advertising to newspapers and church and club periodicals. This is done as a matter of policy and also because the results obtained justify it. The advertisements are keyed so that the value of the publication as an advertisement medium may be checked. Advertisements in religious publications have redounded to the benefit of the company and secured an entrée for its solicitors into homes for the purpose of obtaining a new consumer or of selling some new appliance. This same is true of club periodicals. Most of these publications are got out by trade organizations and by advertising in them and extending every offer to help the organizations in their business, the company has gained their good-will and holds it. A man is employed to write these advertisements and to watch the results.

Electric automobiles are very popular in Rochester and as a

FIG. 3.—ELECTRIC HEATING APPLIANCES IN ROCHESTER OFFICE.

consequence the company does a large automobile charging business. Every one of the 670 electric automobiles in use in the city is charged with energy from the company's mains. The company is supplying energy to operate 141 private charging stations.

The company has gone very extensively into the matter of rates and has published a schedule which it believes is the best that it can give its consumers under existing conditions. The company has not only considered its side of the rate question, but has had the consumer's side in view also when drawing up the schedule. The booklet, which gives the rates offered by the company, was drawn up and published on March 1, 1908. The company states that the reason for issuing the pamphlet is to enable any person within reach of the distribution system of the company to determine for himself when and how the company's product can be used to his advantage. The rates are, of course, subject to supervision of the Public Service Commission of the Second District of New York, with whom the company is in perfect accord.

FIG. 4.—ROOM OF "HOUSE ELECTRICAL."

The base rate is 8 cents net per kw-hour, subject to the following minimum charges:

Up to and including 50 16-cp lamps or equivalent	$1.00 per month
From 50 to 100 16-cp lamps or equivalent	2.00 per month
Over 100 16-cp lamps or equivalent	3.00 per month

A minimum charge of $1 per month is made for each enclosed arc lamp supplied with electrical energy and maintained by the company. When a rate of 8 cents per kw-hour is charged for energy for motors or arc lamps, the minimum charge is determined upon the same basis as the lighting schedule. On the lighting schedule consumers may, at their option, contract upon the guarantee of $10 per month when used for lighting; and in cases where it will work to the consumer's advantage, motors rated at 1 hp or less may (in addition to lighting installation) be placed on the lighting circuits. The lighting schedule may also be used for consumers having a connected motor load of from ½ hp to 10 hp, the consumer guaranteeing a minimum of $5 per month and $1 per month additional for each horse-power or fraction thereof above 5 hp connected to the circuits.

The lighting schedule may also be used on elevator motors, which are rated at one-half the connected load where the minimum charge at the one-half rating does not amount to $10 per month. Motors of 5 hp and under are rated at the actual connected load.

ENERGY RATES FOR LAMPS BASED ON DAILY USE OF CONNECTED LOAD.

Hours' use.	Cents.	Hours' use.	Cents.
1	8	13	3.12
2	7	14	2.71
3	6.8	15	2.94
4	5.9	16	2.87
5	5.22	17	2.81
6	4.65	18	2.75
7	4.24	19	2.70
8	3.94	20	2.66
9	3.7	21	2.62
10	3.51	22	2.58
11	3.36	23	2.55
12	3.22	24	2.52

The schedule applicable to motor circuits may be used on installations of 10 hp and over, upon a guarantee of $1 per horsepower per month, up to and including 20 hp. For connected loads over 20 hp the guaranteed minimum is $20. The schedule

may also be used on elevator motors of 10 hp or over, where the guaranteed minimum is $10 per month. Elevator motors of larger size than 10 hp are rated at one-half normal, the rating in no case being less than 10 hp.

ENERGY SCHEDULE FOR MOTORS BASED ON DAILY USE OF CONNECTED LOAD.

Hours' use.	Cents.	Hours' use.	Cents.
1	8	13	2.78
2	7	14	2.71
3	5.7	15	2.65
4	4.95	16	2.6
5	4.35	17	2.55
6	3.93	18	2.51
7	3.62	19	2.47
8	3.39	20	2.44
9	3.22	21	2.41
10	3.08	22	2.38
11	2.96	23	2.35
12	2.86	24	2.33

The rate for charging storage batteries for electric automobiles is 6.3 cents per kw-hour, with a minimum charge of $2 per month. In addition to this the following rates are given to consumers who guarantee a minimum of $12 per month:

For electrical energy used between the hours of 9 p. m. and 6:30 a. m., 4 cents per kw-hour; for energy used between the hours of 6:30 a. m. and 9 p. m., 3 cents per kw-hour additional. From this rate of 4 and 7 cents per kw-hour a special discount is allowed to consumers whose bills are paid on or before the fifteenth of the month succeeding that during which energy was used or for which bills were rendered, as follows:

SCHEDULE OF DISCOUNTS.

$12.00	to $14.99	10	per cent
15.00	to 19.99	12½	per cent
20.00	to 29.99	15	per cent
30.00	to 49.99	17½	per cent
50.00	to 74.99	20	per cent
75.00	to 99.99	22½	per cent
100.00	to 124.99	25	per cent
125.00	to 149.99	27½	per cent
150.00	to 174.99	30	per cent
175.00	to 199.99	32½	per cent
200.00	to 224.99	35	per cent
225.00	to 249.99	37½	per cent
250.00	to 274.99	40	per cent
275.00	to 299.99	42½	per cent
300.00	to 324.99	45	per cent
325.00	to 349.99	47½	per cent
350.00	and over	50	per cent

In places where it is impossible or impracticable to place arc lamps upon meters and consumers wish to operate lamps upon the same schedule as public street lamps, the price for energy is 25 cents per lamp per night when the lamps are located upon private property. If, however, the lamps are located upon public streets and operated in the same way as street lamps, the charge is the same as that for public street lamps to the city.

In computing accounts under the lighting schedule the following figures are taken as the basis in determining the connected load:

4-cp lamp	20 watts
8-cp lamp	32 watts
16-cp lamp	50 watts
32-cp lamp	100 watts
Enclosed arc lamp	550 watts
1-hp motor	746 watts

After the consumer has contracted for energy on the lighting schedule, a careful inspection of the installation is made and a record kept of the connected load, care being taken to note the number and rated candle-power of the various lamps connected. The connected load multiplied by 26 gives the rating of the installation, if the connected load is used one hour per day for 26 working days per month. The meter gives the kw-hour consumption of the consumer for the month and this divided by the rating of the installation gives the hours' use of the connected load from which the rate is determined.

The energy schedule for motors is worked out in the same manner as the energy schedule for lamps, with the exception that in case there is a number of individual motors installed, instead of taking the total horse-power connected, observations are taken from time to time to determine the maximum demand of the consumer, regardless of the number of motors connected. This is used as the demand load which, multiplied by 26, gives the rating of the installation and the rate is determined as before. A varying rate of discount has been established to apply on bills amounting to $100 per month and over, as shown in Fig. 2.

Consumers who obtain their supply of electrical energy only during the months from March to October, inclusive, in any year, upon the guarantee of $100 gross per month, or over, receive a reduction in rate during these months of one-tenth of a cent per kw-hour from the regular rates; but should the consumer decide to use energy during the four remaining months he is charged two-tenths of a cent per kw-hour in addition to the regular rates.

Consumers who purchase their entire lighting equipment, renew their lamps and trim their arc lamps may consolidate both their lighting and motor load upon one meter and operate under the schedule for energy for motors and have the discount apply to their total consumption.

In explanation of the lighting rate attention is called to the fact that after the fifth hour the consumer pays but 1.8 cents per kw-hour for each additional unit of energy. The following table shows how the rate is worked out and applied:

Hour's use.	Actual rate in cents per hour.	Average rate in cents per hour.	Total amount in cents per hour.
1	8	8	8
2	8	8	16
3	4.4	6.8	20.4
4	3.2	5.9	23.6
5	2.5	5.22	26.1
6	1.8	4.65	27.9
7	1.8	4.24	29.68
8	1.8	3.94	31.52
9	1.8	3.7	33.3
10	1.8	3 51	35.1
11	1.8	3.36	36.9
12	1.8	3.22	38.7
13	1.8	3.12	40.5
14	1.8	3.02	42.3
15	1.8	2.94	44.1
16	1.8	2.87	45.9
17	1.8	2.81	47.7
18	1.8	2.75	49.5
19	1.8	2.70	51.3
20	1.8	2.62	54.9
21	1.8	2.58	56.7
22	1.8	2.55	58.5
23	1.8	2.52	60.3
24	1.8		

A study of this table shows that a consumer can obtain such additional energy as he may desire (over and above that required for his regular and necessary lighting) for electric signs and other forms of display lighting at a low rate, provided that this additional consumption does not increase his maximum demand, and that the energy so used for electric signs or other special lighting is not consumed during the regular and ordinary lighting hours.

The low rates provided for long-hour burning are made possible by reason of the fact that in determining the cost of the production of electrical energy, the charge for investment and depreciation is based entirely upon the maximum demand, or amount of generating and distributing apparatus necessary to furnish such demand. The only costs which enter into the expense of long-hour lighting are the actual generating costs.

The rates for three-phase, 25-cycle, 11,000-volt service, which is only sold in blocks of 100 hp and over, are as follows:

For 100	firm horse-power	$41	per horse-power per annum
150	" "	40	" " "
200	" "	39	" " "
300	" "	38	" " "
400	" "	37	" " "
500	" "	36	" " "
700	" "	35	" " "
1,000	" "	34	" " "
2,000	" " and over	33	" " "

In order to take care of varying loads, the consumer agrees to pay for the excess demand above the "firm" horse-power contracted for on the basis of the average maximum five-minute peaks, as shown in excess of the firm power purchased each month. The consumer may increase the amount of his firm power purchased at his option. The consumer purchases energy at approximately 11,000 volts, delivered at his premises, and supplies the necessary switchboard and transformers and arranges for sufficient space to accommodate the company's meter.

The sole duty of the commercial engineering department is to assist consumers in obtaining the most economical and satisfactory system of lighting and motor service in their stores and factories and operating the necessary machinery at the lowest possible cost, as well as to obtain the most efficient type of apparatus. In other words, the situation as outlined makes it primarily the duty of the department to give the consumer the most it can for his money.

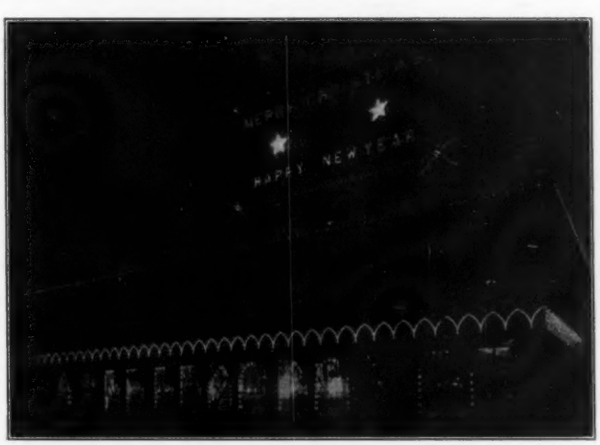
INTERIOR WIRING AND ILLUMINATION

Wiring of Modern Mills Without Regard to Code.

It is not uncommon for mill owners who have erected modern mills with every facility for fighting fire to carry their own insurance. In the wiring of many of these structures, therefore, the Code is sometimes disregarded in order to obtain an installation free from hazard at considerably reduced cost. A case of this kind recently came to our attention. The owners of a large lumber mill in the South decided that in view of its fireproof construction, the building being built of reinforced concrete, it would be economical for the company to carry its own insurance. This freed it from the necessity of observing the strict regulations of the fire underwriters which are designed to give absolute safety under average conditions. Under the ideal conditions existing, obviously a safe job could be installed at less cost. The size of wire was, therefore, determined purely by considerations of drop and safe carrying capacity, and without reference to the capacity of the fuses necessary to give best protection under starting conditions of the motors installed, which are of the induction type. All wires are run in conduit, but no cut-out boxes are installed. Wherever it was necessary to make a tap, a solderless connector was used. By this means a very reliable, efficient and at the same time convenient system of wiring for a mill of this kind was obtained and a considerable saving effected owing to the elimination of numerous junction boxes and excessive lengths of wire, which would otherwise have been required if the Code were followed.

Lighting the Facade of the Denver (Col.) Electric Offices.

Among the many excellent appropriate lighting displays during the recent Christmas holidays in Denver was the roof sign of the Denver Gas & Electric Company, erected especially for the occasion. The letters were brought out in red and green effect, and were richly artistic. The four corners were composed of holly leaves, which the night picture herewith fails to show adequately. The various arches over the windows were also in the green and red effect and gave much strength to the general display. Probably some curiosity may be felt about the ornament on the corner of the building on the roof. This is an Egyptian vase of correct design. Steam is introduced at night, giving the appearance of incense clouds ascending from it.



CHRISTMAS AND NEW YEAR'S GREETING, DENVER, COL.

Difficulties of Electrical Contractors in Small Towns.

An unfortunate condition exists with regard to electrical contracting in a great many towns of 20,000 inhabitants and under. In fact, this condition sometimes extends to much larger cities. This is indicated by the statements which frequently are made by central-station managers at State conventions, to the effect that they have been forced into the electrical contracting business because of the lack of a reliable electrical contractor in the town. It cannot be denied that there is a large number of irresponsible wiremen in the electrical contracting business in a small way, and that the electrical contracting business is in many cases not on the sound and permanent basis that it should be. There is certainly a demand, and a steady one, for electric wiring and supplies in every town where there is reasonably good electric-light service.

Why should the electrical contracting business in many cases be in such an unsatisfactory condition as to the permanency and responsibility of those engaged in it? The condition is probably due to a number of things. One of these is the lack of proper inspection of electrical work in many cities and towns.

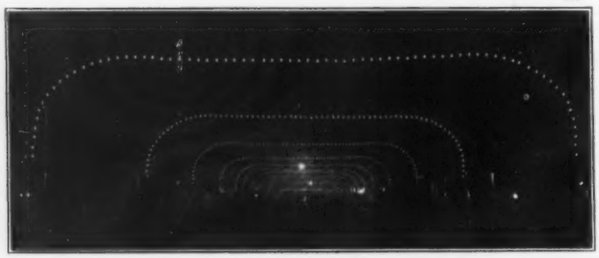
For example, a responsible, conscientious contractor will bid on a piece of work on the basis of installing it in a thorough, workmanlike manner, according to National Electrical Code requirements, but there are usually enough irresponsible wiremen in the neighborhood to offer to do the work for a considerably less sum. They will seldom count on doing the job according to Code requirements, and, not being very good business men, frequently figure too low even if they count on doing their work properly. Such men seldom continue in business long, but there are enough of them to have a demoralizing influence on the whole trade, because after one man has made a failure, there are always more to take his place. These conditions have driven many of the smaller central-station companies to do their own work. Better inspection would help to eliminate this condition. Nevertheless, there are always enough people who appreciate good work to support concerns who do it, and the possibilities of the contracting and supply business in the smaller towns have probably been overlooked by some capable electrical men who are at present engaged in less profitable work. Conditions have been rapidly changing as regards the public demand for electric wiring and supplies the past three years. The awakening of the central-station industry and of the manufacturing interests connected therewith to the importance of more active efforts to push for business would have a stimulating effect all along the line. Electrical conveniences are now much more thought of and used by the general public than three years ago, and conditions are constantly improving.

Arch Lighting at Appleton, Wis.

The city of Appleton, Wis., one of the first to enjoy electric lighting by incandescent lamps, has lately become an exponent of the arch method as applied to the streets, and as illustrated in the accompanying view of a main thoroughfare, College Avenue. There are 25 of these arches built of gas pipe. The supports on each side of the streets consist of 2½-in. pipe, set 3 ft. in the ground, grouted with cement. The 2½-in. pipe extends a distance of 10 ft. above the sidewalk. From the top of the 2½-in. pipe a ½-in. pipe is connected by a reducer, so that the center of the span is 23 ft. above the street grade, the street being 90 ft. in width from curb to curb. As a special factor of safety a 5/12-in. steel strand is used as a support, fastened to the building on each side of the street with a turnbuckle, placed on one side near the building so that the sag is easily taken up at any time. To this cross span the arches are made fast in six places, and are constructed of galvanized-iron wire.

The arches are placed 75 ft. apart. Each arch has 75 8-cp incandescent lamps, with a hard-rubber socket. All the connections are soldered and taped, the work being permanent in every particular, the cost being $35 per arch erected.

The designing of this installation was done by the Langstedt & Meyer Construction & Supply Company in conjunction with the Wisconsin Traction, Light, Heat & Power Company. That this style of construction and erection is perfectly secure and durable was demonstrated before the arches were in place a week. Two wind storms of unusual violence made no impression on any of the arches, although numerous signs and chimneys were demoralized by the high winds.



ARCH STREET LIGHTING AT APPLETON, WIS.

The cost of this installation was paid by subscription, each merchant paying a pro rata in accordance with the number of feet of frontage owned. The current consumption is paid for by the Merchants' Association at the following rates: Twelve cents for the first 100 kw, 10 cents for the next 100 kw, 8 cents for the next 100 kw, 6 cents for the next 300 kw; all over this amount at a rate of 4 cents per kilowatt, with a 5 per cent cash discount. These arches have been used since Dec. 1 four hours each evening, the intention being thereafter to burn them only two or three or four nights a week as may be decided later.

One of the interesting developments of this work was the illumination of a large tree alongside the arches, giving the effect of a huge Christmas tree. This tree is a very large elm that has cast its grateful shade over the thoroughfare many a summer, covering a large area. The ball branches were now festooned with incandescent lamps, to the top of the branches. The result obtained was very pretty and effective.

Indirect Lighting in a Stationery Store.

A system of indirect lighting known as "Eye Comfort," the reflectors and fixtures for which are made by the National X-Ray Reflector Company, of Chicago, has been installed in a number of prominent places in Chicago with notable results. The new offices of the North Shore Electric Company, in the Home Insurance Building, have been equipped throughout with this system of indirect lighting, in which the light is obtained by reflection from any light-colored ceiling. The fixtures are equipped with tungsten lamps. An ordinary lamp with a special shape of "X-Ray" reflector giving the proper light distribution without streaks and shadows on the ceiling is employed. In the accompanying cut is illustrated the interior of the Hartzell, Lord Company's stationery store, on La Salle Street, in Chicago. This store is 30 ft. x 30 ft., and contains four two-light fixtures, each fixture having two 100-watt tungsten lamps. The total wattage is, therefore, 800 and the total square feet area 900. The store was lighted before with exposed clusters of lamps which produced such a glare as to annoy clerks and customers and make the illumination on the goods seem much less than it actually was because of the blinding effect of the exposed lamps.

Wiring Residences at Small Cost.

By Thomas W. Poppe.

In the average town of 5000 inhabitants where the profitable increase of business is a problem to the central-station manager, the wiring of finished residences is a cause of considerable worry. The wiring must be acceptable to the Board of Fire Underwriters and suitable to the owner of the building. Hence care should be taken to conform with the rules as formulated by the underwriters and to avoid damaging any part of the decorations. Should any damage be necessary to the successful termination of the work, care should be so taken that it can be covered by the fittings to be used, as fixture blocks, canopies, switch plates, etc.

While employed by a central station in a town of the above size, the writer had occasion to wire quite a number of residences, some of which were extensively decorated. The prevailing type of building in this town was frame, and the following is a description of the general method of wiring which necessarily had to be done at a low cost to obtain the business.

INDIRECT LIGHTING IN A STATIONERY STORE.

As a typical example, the writer will consider the wiring of a two-story and cellar building containing 12 rooms on the first and second floors and three divisions in the cellar. The owner of the building desired the lamps placed as follows: One lamp in each of the three divisions comprising the cellar; on the first floor a three-lamp electrolier in the parlor, library and dining-room, a two-lamp electrolier in the kitchen, and a drop lamp in the pantry. In the pantry a switch was to be placed to control the three lamps in the cellar. In the hall on the first floor an electrolier containing one lamp was to be placed on the ceiling over the newell post. This lamp was to be controlled by a switch placed in the corner of the hall near the door leading into the parlor and the one leading from the street, so as to be within convenient reach of each doorway. On the second floor a bracket containing one lamp was to be placed in each of the five bedrooms and in the bathroom. At the angle of the hallway a drop lamp consisting of flexible cord and socket was to be placed so as to fairly illuminate the entire hallway.

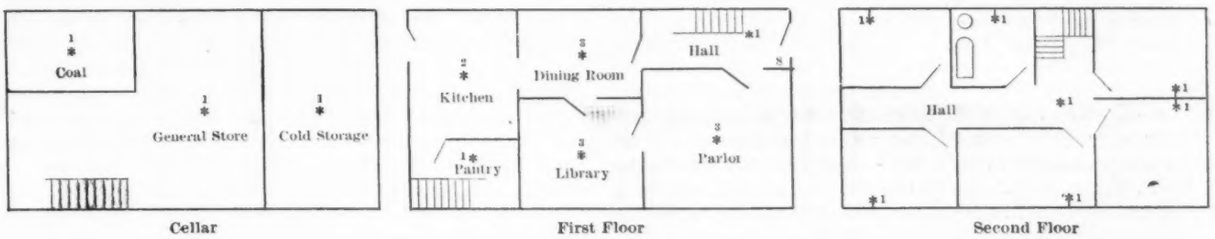


FIG. 1.—PLAN VIEWS OF THE VARIOUS FLOORS.

Fig. 1 will give a general idea of how the rooms and electrical outlets were located. The number of lamps to be installed was 24. As the rules of the underwriters allow only 660 watts on one circuit, it was necessary so to divide the outlets as to allow each circuit to carry its full allowable load of 660 watts, or 12 16-cp lamps. It was decided that the cheapest way, time and material considered, was to place the outlets in the parlor, library, dining-room, hall and the two brackets in the front bedrooms on the second floor on one circuit and the balance of the outlets throughout the house on the second circuit.

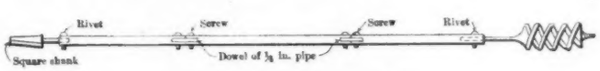


FIG. 2.—EXTENSION AUGER.

As the overhead alternating-current system supplied the town, the service mains were brought into the attic, where the service switch, fuses and meter were placed. The location of the brackets in the front bedroom were then determined, and a board removed from the attic flooring. This board was directly over the partition upon which the brackets were to be placed. Through the ceiling plate, which is generally a joist 2 in. x 4 in. (Fig. 4), four holes ¾ in. in diameter were bored. Through two of these holes a long bit (Fig. 2) was placed and two ¾ in. holes bored through the floor plate (Fig. 4) and flooring of the second floor. In doing this care was taken to avoid boring through the lath and plaster of the partition. This brought the auger bit into a cavity formed by the beams supporting the second floor, the lath and plaster of the first floor ceiling and the flooring of the second floor. Below the brackets on the second floor a pocket was removed from the flooring. This allowed access to the auger bit. As it was necessary to draw wire and flexible tubing through the holes made by the auger bit and upward through the hollow space of the partition to the attic floor a piece of strong cord was attached to the auger bit by tying it to the shank and winding it around, following the spiral formation of the bit until the screw part, generally termed the worm of the bit, was reached, where it was again fastened by tying two half hitches around the worm. This was done as each hole was finished. When the bit was withdrawn from the hole the cord naturally followed it. In this way fishing or mousing for the holes, two methods which require patience and often too much time, were avoided and a good drawing-in arrangement obtained. To each of the cords mentioned a wire long enough to reach from the nearest outlet in the attic floor to the nearest outlet on the second floor was attached. The wire was then drawn upward, and flexible tubing long enough to reach from the nearest support in the attic flooring to the nearest support under the second floor was pushed upward, enclosing each wire. The underwriters' rules are very strict regarding flexible tubing, requiring it to be placed in position in one continuous piece from support to support, or from support to outlet, or from outlet to outlet. Through the wall at the height and place where the brackets were to be placed a hole 2 x 2 in. was cut through the partition. Through these holes and through the remaining holes in the partition plate above a piece of reed or rattan ¼ in. diameter, with a hook attached (Fig. 3) was pushed, it being necessary to fish the hook at the opening in the partition. This was done by means of a piece of stiff wire, with a small hook on one end. This hook easily engaged the hook on the reed, or rattan, and the latter pulled outward.

FIG. 3.—RATTAN FOR FISHING.

To the hook on the rattan a wire sufficiently long to reach the nearest support overhead was attached and drawn upward. Over each of these wires was placed flexible tubing to reach from the nearest support to a point 3 in. from the wall, where the brackets were to be placed. Fig. 4 shows how the wires were arranged to comply with the rules of the underwriters.

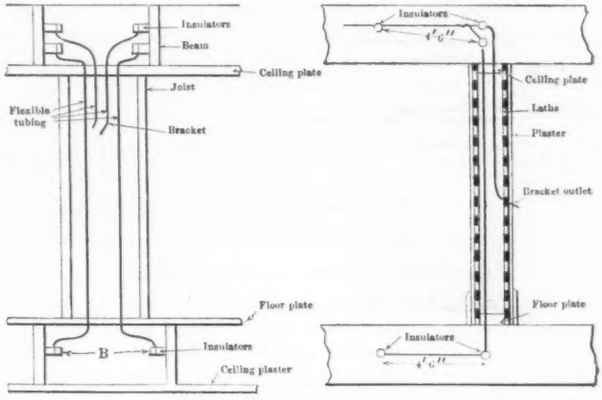


FIG. 4.—WIRING DETAILS.

From the porcelain split knob, which constituted the wire support in this case, two wires were drawn between the beams to the center hall electrolier outlet. One of these wires was taken to the switch outlet and from the switch outlet to the electrolier. This constituted a single pole switch loop to control the electrolier lamp. The means of wiring from the floor to the

switch outlet in the hall were identical to those used in wiring for the brackets.

When drawing wires between beams, as in this case, it is necessary to fasten the wires on porcelain insulators, so as to support them rigidly or as nearly so as possible. The wires should be drawn tight so as to have no slack wire, which might come in contact with any part of the construction of the building. To attain this condition it is necessary to space the insulators at not more than 4½ ft., and the nearer the insulators are spaced the more easily the conditions are maintained.

To wire to the center of the parlor below it was necessary to remove pockets from the flooring until a board which ran directly over the center of the parlor was reached. Two wires were connected to the wires coming from the attic at the point *B*, Fig. 4, and drawn between the beams and supported as explained. To get to the center of the room it was necessary

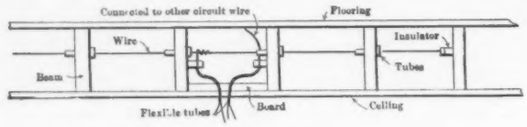


FIG. 5.—CONNECTION FOR CEILING OUTLET.

to bore through the beams and draw the wires through the holes made. In every case when this was done the holes were bushed by a porcelain tube having an internal diameter sufficiently large to allow the entrance of the wire without abraising the insulation. The holes, made in the beams, were of sufficient size to allow the porcelain tube to be placed therein by hand without the use of any force. The tubes for this purpose have a shoulder on one end and project through the beam at least ⅛ in. The holes containing tubes were given a slight pitch downward so that when the wires were drawn in tightly the tendency was to wedge the tubes, thus insuring their remaining in the one position, Fig. 5.

Fig. 5 also shows how the wires were arranged when connections were made for a ceiling outlet. The wires going through the ceiling were connected to the circuit wires and fastened by means of a porcelain insulator on each wire. On these wires flexible tubing was placed. The tubing in every similar case should reach from the insulating support to a point 3 in. below the ceiling. Before boring the holes in the ceiling to allow placing the tubing and wire through the lath and plaster a piece of board was fastened between the beams to carry the weight of the electrolier. The rest of the rooms were wired in a like manner, except the cellar, where the ceiling was bare of lath or plaster. The holes in the beams here were bored from below, making it unnecessary to remove any of the flooring.

When placing the brackets in position it was necessary to fasten a round block of wood ⅞ in. thick to the wall over the holes made for the exit of the wires to carry the weight of the brackets. Before fastening the blocks, holes large enough to admit the flexible tubing were bored through them. The brackets were then placed in position, using a crowfoot to sustain them. It was not necessary to place a block between the crowfoot and ceiling plaster when hanging the center electroliers, as the boards placed between the beams carried the weight. Care should be taken, however, in cases of this kind to use screws long enough to engage about ¾ in. of the board. To avoid any possibility of the electrolier working loose, owing to the toes of the crowfoot working into the plaster, holes were drilled into a sheet-iron disk of sufficient diameter to cover all three toes of the crowfoot. The holes drilled into the disk were so placed that the same screw fastening the crowfoot would also support this disk between the crowfoot and plaster. This gave a larger pressing area and lessened the possibility of the electrolier working loose. This system of wiring is absolutely safe and admits of a good job being done at reasonable cost.

LETTER TO THE EDITORS.

Chart for the Calculation of the Size of Copper Conductors in Transmission Lines.

To the Editors of Electrical World:

SIRS:—In the article written by the undersigned, entitled "Chart for the Calculation of the Size of Copper Conductors in Transmission Lines," one of the examples employed for illustrating the use of the transmission line chart, which was printed as a supplement to the first issue in January, 1909, contains a numerical error occasioned by the use of 0.70 as the power factor in one case and 1.00 in another. In example 3, page 38, the value of 0.70 should have been used throughout for the power factor. Thus the resistance volts loss should be 2100 instead of 3000, giving the value of 0.76 for the resistance volts loss per mile per ampere and, therefore, requiring a wire between No. 2-0 and No. 3-0 instead of No. 0 wire. The regulation volts for a No. 2-0 wire would be 0.95 volt per mile per ampere, or 2630 volts total, which is 8.8 per cent of the delivered e.m.f. of 30,000.

In example 4 the calculation of total line loss, the value 2275 volts represent the true volt loss—that is, the resistance voltage drop. If this value is multiplied by the current in the line—namely, 102.4 amp, and if this is expressed as a per cent of the power delivered—namely, 4300 kw, the loss in power is found to be 5.43 per cent of the delivered watts.

On page 37 there appears an error where the word "larger" in the sentence reading "the regulation volts or line drop determined from the chart will be somewhat larger than the true value" should read "somewhat smaller than the true value."

MONTREAL, CANADA. L. A. HERDT.

DIGEST OF CURRENT ELECTRICAL LITERATURE

Abstracts of the important articles appearing in the electrical periodical press of the world

Generators, Motors and Transformers.

Interpoles.—E. O. TURNER.—A paper read before the Glasgow Students' Section of the (British) Inst. Elec. Eng. on commutation-pole design. The author gives the formulas used in their calculation. A method of finding the flux density in the interpole gap is first outlined, the necessary ampere-turns are found and the dimensions of the pole-shoe are fixed. The leakage coefficient is then worked out by means of the quantities already obtained. From this, lastly, the size of the pole core is determined.—Lond. *Electrician*, Jan. 15.

Predetermination of Dynamo-Electric Machinery.—R. V. PICOU.—The first part of a paper on the predetermination of the behavior of a machine of given design. There are many graphical methods available for this purpose and the author endeavors to develop from them a method of calculation, which shows the degree of exactness of the calculation. In the present installment the author discusses the problem in a general way and gives with the aid of diagrams all of the elements which are necessary for such a predetermination.—*La Lumière Elec.*, Jan. 9.

Armature Reaction.—E. SIEDEK.—An illustrated translation in abstract of his recent German paper on distortion of pressure curves due to load in alternating-current generators. The author gives results of an oscillographic investigation of the effect of armature reaction in alternators, whereby the now generally accepted theory is experimentally confirmed. He deals with the distortion of pressure wave in a single-phase alternator and in a polyphase alternator with balanced and unbal-

anced load, and discusses the effect of loading one phase on the pressure curves of the other phases in a polyphase alternator.—Lond. *Electrician*, Jan. 15.

Leakage Fluxes in Induction Motors.—R. E. HELLMUND.—An illustrated article in which the author shows that the graphical method which he has formerly used for studying the rotary field of an induction motor is also very suitable for investigating the leakage fluxes. On the basis of his vector diagrams, he develops some simple formulas.—*Elek. Zeit.*, Jan. 14.

Rheostats for Induction Motors.—L. SOLOMON.—The author gives graphical solutions of the problem of determining the resistance to be inserted in the rotor circuit of a polyphase induction motor for starting and controlling purposes. The graphical method is based on some simple additions to the familiar Heyland circular diagram.—Lond. *Electrician*, Jan. 15.

Lamps and Lighting.

Tungsten Lamp.—A note on a British patent of the Allgem. Elk. Ges. (28,138, 1907; Jan. 7, 1909). The fusing point of a tungsten filament is reached when the specific consumption is reduced to 0.33 watt per candle. If the filament is heated to a temperature corresponding to a consumption of from 0.7 to 0.8 watt per candle, the resistance of the filament gradually increases, as it softens and sinters together, becoming thicker and shorter. This allows the current to increase, and the filament is soon burned out; serious blackening of the lamp does not occur, however. According to the present invention, it is proposed to insert a resistor with a positive resistance-temperature coefficient, such as an iron coil in a bulb filled with hydrogen, as used as a ballast resistor for Nernst lamps, in series with the tungsten filament to enable it to be run at a specific consumption of 0.7 to 0.8 watt per candle, without unreasonably shortening the life of the lamp. Thus a filament taking 0.6 amp at 140 volts at this specific consumption could be operated on a 150-volt circuit, the iron resistor absorbing 10 volts. Variations in the supply pressure will be compensated for, and the reduction in the resistance of the filament will be retarded. The resistor could be placed in the lamp itself. By running the filaments at such a low specific consumption, the length of filament for a given e.m.f. is considerably shortened, and the lamps can, therefore, be constructed for comparatively high voltages.—Lond. *Elec. Eng'ing*, Jan. 14.

Tungsten Lamp.—A note on a British patent of F. J. Planchon (4956, 1908; Jan. 7, 1909) for an improved process for preparing a homogeneous plastic compound of tungsten for squirting into lamp filaments. A carbo-hydrate, such as gum arabic, starch and cellulose, is dissolved, and the "aqueous or alkaline solution obtained" is mixed with an alkaline solution of tungstic acid. The mixture is then poured into dilute hydrochloric acid, and a precipitate, which is a chemical compound of tungstic acid and carbo-hydrate, is obtained. The precipitate is washed and made into a paste with water, after which it is ready for the usual squirting process.—Lond. *Elec. Eng'ing*, Jan. 14.

Generation, Transmission and Distribution.

Friction Brakes.—H. D. JAMES.—An article on the design of friction brakes to be used in connection with electrically driven hoisting machinery. The author emphasizes the fact that a friction brake should be designed and applied as carefully as a motor. The work that the brake is to do should be clearly outlined and the characteristics of the machinery to which it is attached should be stated. A brake suitable for a crane is not suitable for a passenger elevator. If the load is to be lowered a considerable distance, some method of artificial cooling may be necessary, such as the use of water. Wherever possible brakes should be mounted on the motor shafts, as their size is determined by the torque only, and if a brake is run at a speed lower than the motor, it must be correspondingly larger.—*Elec. Jour.*, January.

Explosion in Suction-Gas Plant.—H. WEGENER.—In a Berlin electric generating station an explosion recently occurred in a suction-gas plant. Since such plants are considered generally free from danger so that not even a license is required, the causes of the explosion were carefully investigated. It was found that the gas mixture had been such as to have a maximum of explosive effect. This effect was attributable to an excess of air, and three possibilities are discussed by which the excess of air had been sucked in. The explosion itself could only have been started by back ignition from the gas engine. Remedies to prevent such occurrences are described, and it is stated that this accident was due to the joint action of several incidental circumstances all tending in the same direction.—*Elek. Zeit.*, Jan. 14.

Pulverized Fuel.—R. K. MEADE.—A paper read before the Amer. Inst. Chem. Eng. While practically all of the Portland cement is now burned in this country with pulverized coal, this method of using fuel in powdered form is hardly used in other industries. The author summarizes the advantages of pulverized coal over solid coal and producer gas, and describes methods for burning pulverized coal for certain purposes, especially open-hearth furnaces. With special designs, he claims, it could also be used for boilers.—*Electrochem. and Met. Ind.*, February.

Losses in Steam-Power Plants.—W. M. BOOTH.—A paper read before the Amer. Inst. Chem. Eng. on steam-power plant economics. The author discusses the different losses in a steam-power plant from the standpoint of the chemical engineer.—*Electrochem. and Met. Ind.*, February.

Traction.

English Traction Statistics.—Statistical tables of the electric traction systems of the United Kingdom. There are three tables: the first covers tramways which obtain electricity from a combined lighting and traction station; there are 136 systems of this kind. The second table refers to tramway systems which have generating stations for traction only, there being 47 systems of this kind. The third table relates to electric railways under construction; there are 16. The total length of tramway track now recorded in the tables is 3843 miles, compared with 3651 miles last year. The tables contain 28 different columns, giving an immense amount of information concerning history, equipment, etc. A new column gives the method of bonding employed on the various undertakings. A point which is thereby brought into prominence is the number of tramways on which thermit welding is in use, though in some cases it is for experimental purposes only. There are many tramway systems on which a gradient of 1 to 9 exists, while in three instances the figure approaches 1 to 8. In the course of a few months the total length of railroad track in England on which electrical working is in operation will be 411 miles, this including the London Bridge-Victoria route of the London, Brighton & South Coast Railway.—Lond. *Electrician*, Jan. 15.

Rolling Stock.—M. STAHL.—His report before the International Tramway and Light Railway Association, giving a summary of answers received in reply to different questions concerning the life and wear of rolling stock. In dealing with the answers sent out to the different companies, the author has divided his report into a number of sections. Under these he reports on axles, wheels and tires, axle boxes, car frames and gearing. These sections are again subdivided into appropriate headings which summarize the answers on the particular points; at the end of each section the author puts forward his own conclusions on the subject. In this way the general design of axles, journals, wheels, tires and axle boxes, with the methods of lubrication and the cost of upkeep of the various parts, which are obtained from figures provided by the members, are given. Moreover, the lay-out of the car frames, details of the springs, sand boxes, and of various types of axles with their advantages and disadvantages are outlined. The question of the proper design of gearing with the upkeep costs of various types is also dealt with.—Lond. *Electrician*, Jan. 15.

Surface-Contact System.—S. CLEGG.—An illustrated paper read before the (British) Institution Elec. Eng. on the "G. B." surface-contact system from a tramway manager's point of view. The author describes the "G. B." system as installed at Lincoln, and then proceeds to relate his experience with it under working conditions. Particulars of the number of live studs are

given, together with their causes, and it is shown what alterations have been found necessary to render faults unlikely to occur again. A comparison is finally made between the "G. B." and the overhead systems, the former comparing very favorably as regards reliability, sightliness, safety to the public, silent running and maintenance cost, sufficient in many cases to offset the additional 10 per cent in capital outlay.—Lond. *Elec.*, Jan. 15.

Single-Phase Traction.—H. Studer.—The conclusion of his illustrated article on the single-phase traction system on the Seebach-Wettingen line. The author discusses the troubles which were experienced on account of the inductive effect on telephone lines in the neighborhood. He finally summarizes briefly the results obtained with electric traction. During the first four months steam locomotives had to be used in three cases; the reasons are stated.—*La Lumière Elec.*, Jan. 9.

Single-Phase Traction.—Henry.—An illustrated article on single-phase traction on European railways in 1908. Concise descriptions of the different systems used are given.—*L'Industrie Elec.*, Jan. 10.

Simplon.—F. De Weldon.—The first part of an illustrated description of the electric installations of the Simplon Tunnel.—*La Lumière Elec.*, Jan. 2.

Installations, Systems and Appliances.

Auto-Transformer Switch.—A description of a new switch of British make for auto-transformer installations, shown in Fig. 1. *A* is a laminated core, having pole-pieces *B*, *C* and *D*; *E*

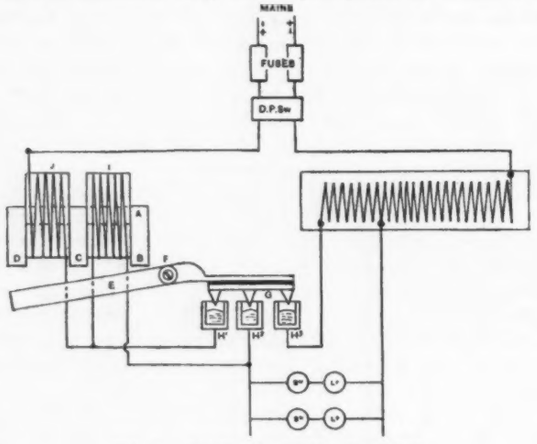


FIG. 1.—DIAGRAM OF CONNECTIONS.

is a laminated armature, pivoted at *F*. *G* is a contact plate with three conical dippers, arranged to enter the mercury cups H^1, H^2 and H^3. *I* and *J* are the actuating coils, *I* being wound with a large number of turns of fine wire, and *J* with a small number of turns of wire of a gage suitable for carrying the maximum primary current required by the transformers. The coils *I* and *J* are in series with each other, and with the lamps and transformer *T*. The high-resistance coil *I* is also connected across the mercury cups H^1 and H^2, while the lamps and secondary of transformer are across the cups H^2 and H^3. The action is as follows: When the first lamp is switched on, a circuit is formed through coils *I* and *J*, lamp and transformer. The small resulting current, owing to a large number of turns in coil *I*, and the proximity of the armature to pole-pieces *B* and *C*, is sufficient to raise the armature *E*, and place the dippers in the mercury cups. The lamps are thus placed in the secondary circuit of transformer, and the high-resistance coil *I* is shorted, but the armature having been raised against the pole-pieces *C* and *D*, the coil *J* is able to hold it in that position. The switching on of additional lamps increases the attraction, but when the last lamp is switched off, the armature drops by its own weight, and the transformer is cut out. The switch will cut in and hold it with a 15-watt lamp in circuit, and the voltage loss due to the coil *J* is only 1 per cent.—Lond. *Elec. Rev.*, Jan. 8.

Balancing a Three-Wire Network.—B. Sankey.—An article emphasizing the importance of carefully balancing the two sides of a three-wire, direct-current network, especially in small towns. It is recommended to divide the consumers into not less than three distinct classes and to balance each class separately. These three classes are: first, the early-hour consumers; second, evening consumers; thirdly, late-hour consumers and miscellaneous. A card-index system is recommended.—Lond. *Elec. Rev.*, Jan. 8.

Brussels.—A. Oschinsky.—A continuation of his illustrated description of the new generating station of the city of Brussels. It contains four steam-driven, three-phase generators, the voltage being 5000 and the frequency 50. Three of the generators have a capacity of 3500 kv-amp, the fourth of 2050 kv-amp.—*Elek. Zeit.*, Jan. 14.

Switchboard.—P. Frenell.—A continuation of his illustrated article on the Hemsjö Power Company, in Sweden. In the present instalment the author describes the switchboard. The principle followed in the design is that each integral part of it can be disconnected and repaired, whenever necessary, without causing the least interruption to the normal service.—Lond. *Electrician*, Jan. 15.

Wires, Wiring and Conduits.

Insulators.—F. S. Denneen.—An abstract of an illustrated paper, read before the Central Electric Railway Association, on insulators for high-tension transmission lines. The author discusses the action of an insulator under stress, the chief features of insulator design and the construction of insulator pins, and makes suggestions for insulator specifications.—Lond. *Electrician*, Jan. 15.

Electrochemistry and Batteries.

Detinning.—K. Goldschmidt.—An illustrated article giving a review of the detinning industry. Electrolytic detinning is first described. The tin scrap is used as anode in hot caustic soda solution. The tin is precipitated in spongy form on the cathodes. More recently detinning with chlorine is found more profitable, the products being steel and tin tetrachloride. Old, used tin cans are also now treated, but require a preliminary purification process.—*Electrochem. and Met. Ind.*, February.

Nitric Acid from Air.—W. Cramp and B. Hoyle.—An abstract of their recent paper before the (British) Inst. Elec. Eng. on the production of nitric acid from air by electric discharges. The different forms of electric discharges through air and their chemical effects are analyzed.—*Electrochem and Met. Ind.*, February.

Units, Measurements and Instruments.

Photometer.—An illustrated description of the latest form of the Harrison universal photometer. The instrument is intended for the measurement of illumination on a screen making an angle of 45 deg. with the vertical, and for the measurement of the candle-power of various sources of light. It is provided with a flicker disk rotated by a blast of air under the control of the operator. By fixing the flicker disk to half cover the field of view of the eye-piece, the instrument may be used as a direct-comparison photometer, the illumination of the source of light being compared directly with that of the adjustable screen inside the instrument, illuminated by a small standard lamp connected to a self-contained accumulator battery. The latest addition to the instrument consists of a horizontal screen, which is covered by a cap when the flicker disk is used. This cap has a hole through the center, and forms the eye-piece of the instrument. When the cap is removed the horizontal screen is exposed, and by fixing the flicker disk out of the field of view of the eye-piece, by means a small milled-headed screw, the photometer can be used to measure horizontal illumination by direct comparison. Fig. 2 gives a general diagram of the instrument, together with an enlarged view of the eye-piece. *S* is the adjustable screen, attached to the pointer; *P* the pointer on outside of case; S_2 the revolving sector screen for general illumination; S_3 the screen for horizontal illumination; *M* the reflecting mirror; L_1 and L_2 are standard lamps; *C* is the cover cap, to be removed when observing horizontal illumination, and *G* the glass in the eye-piece. The following tests can be made with the instrument: Candle-power by means of the flicker disk; candle-power by the direct-comparison method; illumina-

tion on the screen at an angle of 45 deg. by the flicker disk; illumination on the screen at an angle of 45 deg. by the direct-comparison method; horizontal illumination by direct comparison. The advantages of the instrument are light weight and portability and a long range due to the use of two standard lamps of different candle-powers. Permanent connections are

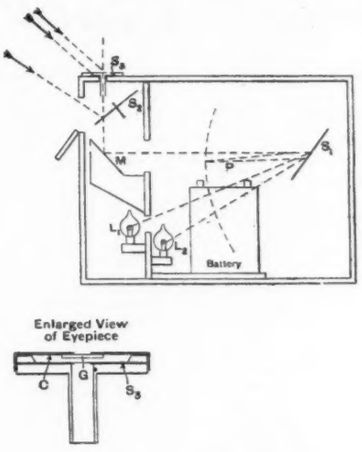


FIG. 2.—UNIVERSAL PHOTOMETER.

made between the battery and the rest of the circuit, which need never be disconnected for charging purposes, and the battery, standard lamps and flicker disk may be readily removed from the instrument for inspection without disconnecting or altering any adjustments.—Lond. *Elec. Eng'ing*, Jan. 14, and Lond *Electrician*, Jan. 15.

Resistance Pyrometry.—E. F. NORTHRUP.—A paper read before the Amer. Inst. of Chem. Eng. on modern electric resistance pyrometry. Of the different parts of a resistance pyrometer, the indicator and the resistance thermometer bulb have been worked out by the manufacturer until they are now no longer unreliable. However, to avoid disappointments it is important to take good care in the wiring system. Up to about 1200 deg. C. the resistance thermometer is the most suitable, above 1200 deg. and below 1600 deg. C. the platinum-platinum rhodium thermocouple must be used. Above 1600 deg. C. radiation or optical pyrometers must be employed. Applications of resistance thermometers in various industries are sketched.—*Electrochem. and Met. Ind.*, February.

Induction Ammeter.—P. MACGAHAN.—The first part of an illustrated serial on alternating-current instruments. In this instalment the author deals with the disk-type induction ammeter and voltmeters. While this form of indicating instrument is at present superseded by other forms, it has been manufactured and installed in large numbers.—*Elec. Jour.*, January.

Meter Connections.—H. W. BROWN.—A continuation of his illustrated serial on meter and relay connections. The author deals with the use of single-phase meters on three-phase, three-wire circuits.—*Elec. Jour.*, January.

Direct-Current Meter.—An official communication of the Reichsanstalt, by which a direct-current motor-meter of a German company for two- or three-wire systems is admitted for calibration.—*Elek. Zeit.*, Jan. 14.

Meters.—An article pointing out that the watt consumption and the first cost of electricity meters are economically important. For small installations it is thought that electricity meters should be recommended only when the consumer pays a rent for the meter or a high rate for the energy consumed.—*Elek. Ans.*, Jan. 10.

Water Rheostat.—G. KRIBS.—An account of several cases in which a water rheostat could be employed in emergency. One case was the test of a high-voltage generator at constant power factor, while in the other cases the water rheostat was used as a substitute for a missing controller and for a motor starter.—*Elec. Jour.*, January.

Telegraphy, Telephony and Signals.

Loaded Telephone Lines.—R. NOWOTNY.—An illustrated article on two new types of loaded telephone line construction on the Pupin system, used in Austria. In the older lines, in that country, troubles had been experienced in two directions. Firstly, the self-inductance of the coils was found to change with time; while in some cases the changes were small, they became as high as 30 per cent in others, being sometimes an increase and sometimes a decrease of inductance. Since coils were inserted alternately in the two conductors of the two-conductor line, the result was an unsymmetrically loaded line. To remedy this, double coils are now used in order to assure that both conductors of the line remain equally loaded. The two conductors are now wound over a common iron coil (as in American practice) and it has been found that the symmetry of the loaded line was thereby preserved. The second trouble experienced was due to small boys throwing stones at the coils. For this reason the coils are now surrounded by metal cases.—*Elek. u. Masch.* (Vienna), Jan. 3.

Induction from Single-Phase Railways on Telephone Lines.—R. DAHLANDER.—An account of an investigation with respect to the proposed use of single-phase current on the Swedish railways. The author first investigates the case of a telephone line insulated at both ends and running parallel to the traction system along its whole length. He determines separately the induced static tension, the induced electromagnetic tension, and the tension due to the voltage drop in the traction line. For short lines the induced voltage is chiefly of static nature. He then takes up the case of a telegraph line earthed at both ends and parallel with a line. Finally, the case of a double-conductor telephone line is considered. The article gives chiefly the mathematical formulas of these different cases.—*Elek. Zeit.*, Jan. 14.

Two-Tone Vibrating Transmitter.—E. RAYMOND-BARKER.—An article on the use of his two-tone vibrating transmitter for inductive signaling. The author discusses separately the application of the transmitter in an inductive-signal system for maintaining telegraphic communication between ship and shore—within certain *KR* limits—during a ship's final operations on a cable repair, when the cable conductor is no longer accessible for electrical signaling by ordinary methods.—Lond. *Electrician*, Jan. 15.

Directive System of Wireless Telegraphy.—E. BELLINI AND A. TOSI.—An illustrated abstract of a (British) Physical Society paper. The authors' bilateral directive wireless telegraph system is first briefly described, after which particulars of a new unilateral directive method are given, depending on the simultaneous use of closed oscillatory aerial circuits and vertical antennæ.—Lond. *Electrician*, Jan. 15.

Telegraphone.—C. F. FRANKHAUSER.—A Franklin Institute paper on the principles embodied in the telegraphone, its accomplishments in actual experience, and its influence on commercial and social life.—*Jour. Franklin Institute*, January.

Miscellaneous.

Electric Light for Therapeutic Purposes.—O. VOGEL.—An article on the Finsen method for treating certain skin diseases by means of electric light. To kill bacteria, the blue and violet rays are most suitable, since they kill all bacteria with certainty within five minutes and pass deeply into the tissues. On the other hand, ultraviolet rays have an etching effect and do not go too deeply into the tissues; while it formerly was thought that the ultraviolet rays were of special therapeutic value, this has now been found to be an error, and the endeavor is now to use blue light. This has naturally had an effect on the construction of lamps for therapeutic purposes. The author emphasizes that the endeavor should be to further simplify and cheapen the apparatus and to increase the intensity of the rays which have a therapeutic value, so as to reduce the time of application.—*Elek. Zeit.*, Jan. 14.

Slide Rule.—A description of a new slide rule which is intended especially for the use of electrical engineers. One of the problems for which it is specially intended is the calculation of

electric wiring. It is also possible for one to be able to read off directly squares, cubes and fourth powers and also the square-roots, cube roots and fourth roots of figures.—*Elek. Anz.*, Jan. 7.

Electric Welding.—The first part of an illustrated article on the different methods of electric welding, especially in British practice.—*Lond, Eng'ing*, Jan. 15.

Electric Piano Player.—J. F. Kelly.—An illustrated sketch of the development of the electric piano-player.—*Jour. Franklin Inst.*, January.

NEW APPARATUS AND APPLIANCES

The 110,000-Volt Transmission Line of the Grand Rapids-Muskegon Power Company.

Considerable interest has been aroused by the 110,000-volt transmission line of the Grand Rapids Power Company which, now that it has been operating satisfactorily for six months, has proved the entire practicability of this voltage for long-distance electric transmission of power.

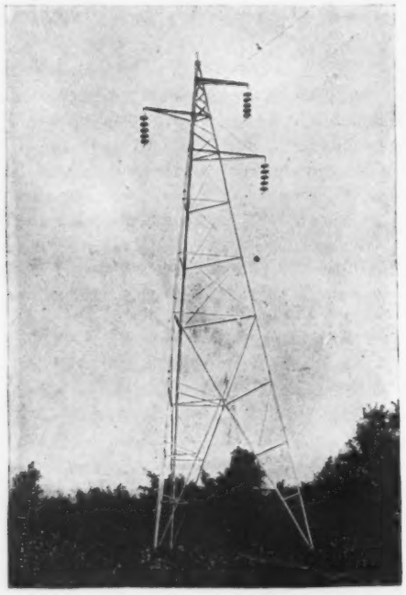


FIG. 1.—STEEL TOWER.

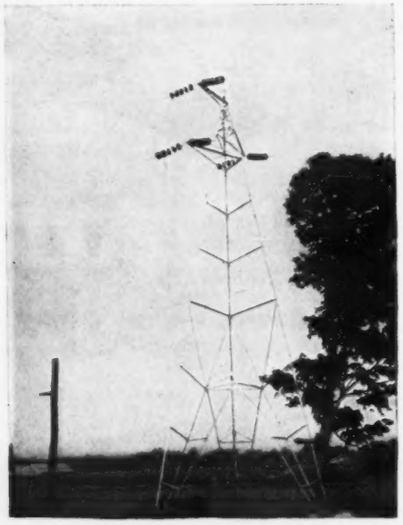


FIG. 2.—STEEL TOWER.

FIG. 3.—DISK INSULATOR.

The line, which runs between Grand Rapids and the Croton Dam, Mich., a distance of 50 miles, is carried on triangular steel towers approximately 53 ft. in height over all and 43 ft. 8 in. from the ground to the lowest cross-arm, and designed to give a 40-ft. clearance between the line wire and ground. The towers weigh approximately 1700 lb. each, and provide a minimum spacing between the insulator hangers of 8 ft.; they are placed on large concrete anchors buried in the ground, and are spaced 528 ft. apart on tangents (Figs. 1 and 2). The anchors consist of 3-in. angle steel, 7 ft. 10 in. long, encased in concrete. The anchors each extend about 10 in. below the bottom of the concrete in which they are encased, thus securing a ground for the transmission line.

In view of the many troubles experienced by the large majority of companies when first starting a high-tension transmission line using pin insulators, a report made on the operation of this line is of special interest. This report states that "this line has been in operation since July 18 last, and we have experienced no trouble whatever. Nothing of an unusual nature has occurred and we consider its operation as very satisfactory and successful."

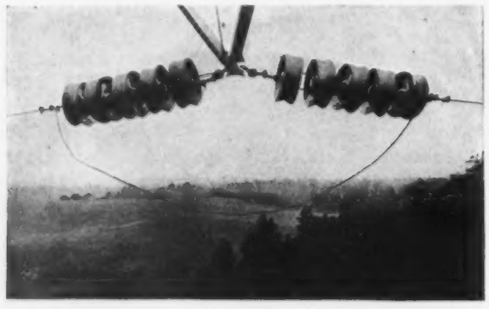


FIG. 4.—DISK INSULATOR.

The majority of the right of way is located along the highways, and only a tower right was taken. Where the line passes through forests or makes short cuts across country, a strip of land was purchased, varying in width from 33 ft. to 66 ft., according to circumstances. This land is usually fenced off. No protection whatever is used where the lines cross highways or traffic routes.

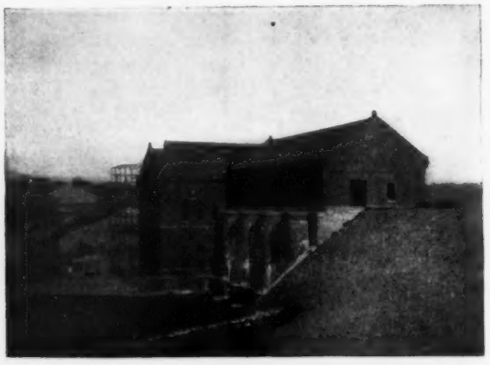


FIG. 5.—CROTON DAM POWER STATION.

The insulators are of the standard General Electric disk pattern, the suspension type being used for a straight support and the strain type for pull-off curves. Five of these 10-in. disks

are used in series, the arrangement being very clearly shown in Figs. 3 and 4. Each disk is rated at 25,000 volts.

The line transmits 10,000 kw, the conductors consisting of No. 2 stranded, hard-drawn copper wire with hemp center. The lines are spaced 8 ft. apart and are entirely without transposition throughout the whole length. No guard wire is used. The lines are brought into the stations through porcelain insulators and are connected directly to the high-tension transformers, which are delta-connected on both sides. There are no switches of any kind in the lines, the control being by means of generator field switches.

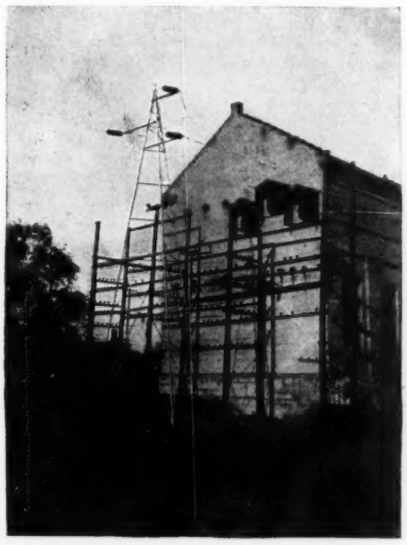


FIG. 6.—CROTON DAM POWER STATION.

The pressure was first applied to the transmission line on July 18, 1908, and it was noticed that the line was a little noisy at the working pressure of 110,000 volts, while at night the atmospheric discharge was distinctly visible. Wattmeter ratings on the empty line, after deducting the core losses of the step-up transformers, seemed to indicate a constant loss on the 50 miles of line of from 20 to 25 kw.

FIG. 7.—STATIC DISCHARGE FROM THE LINE.

Other interesting features of the line are shown in Figs. 5 to 7, inclusive.

Chicago Show Exhibit.

An attractive exhibit at the Chicago Electrical Show was that of the Stave Electrical Company, of 27 West Twenty-seventh Street, New York, in which was shown the "Stave" flaming-arc lamps in several types. These lamps are designed for alternating-current or direct-current circuits of from 110 to 550 volts, and have recently been adopted for the exterior illumination of a number of prominent theaters. The company's booth was one of the brightest spots of the show.

Conkling Reversing Mechanism for Machine Tools.

A mechanical device which is of interest to electrical men because of its application to motor-driven tools and other mechanisms where quick reversing is required, is the Conkling reversing mechanism, made by the Conkling Company, Ninety-sixth Street and Erie Avenue, Chicago. Fig. 1 shows the application of this mechanism between a motor and a planer which it is driving. The mechanism with the top casing removed is shown in Fig. 2. As can be seen from Fig. 2, the driven shaft operates from a bevel gear, being driven from one side or the other, according to the direction of rotation. These bevel gears are in turn operated by a clutch-driven mechanism inside the casing. The great advantage claimed for this reversing mechanism is that the action of the clutch is so easy that there is no jerk which disturbs the load on the motor to any great extent. For example, with a motor driving a machine with 8-amp load, the increase in current when the reversing takes place is stated to be only 1.5 amp, or about 18 per cent. The clutch in this mechanism which accomplishes the reversing consists essentially of three parts. A two-piece nut closes down on a continuously revolving belt whenever the cam operated by the machine tool trips the reversing mechanism. This two-piece nut slowly drives a wedge in such a way as to force a friction clutch into engagement. The mechanism as shown is arranged for driving at full speed through the set of gears on the left and at partial speed through the gears on the right, thus acomplishing a quick reverse. The clutch is steel to steel. It releases instantaneously by the opening of the two-piece nut which engages the threads on the shaft. The mechanism is completely encased and runs in oil.

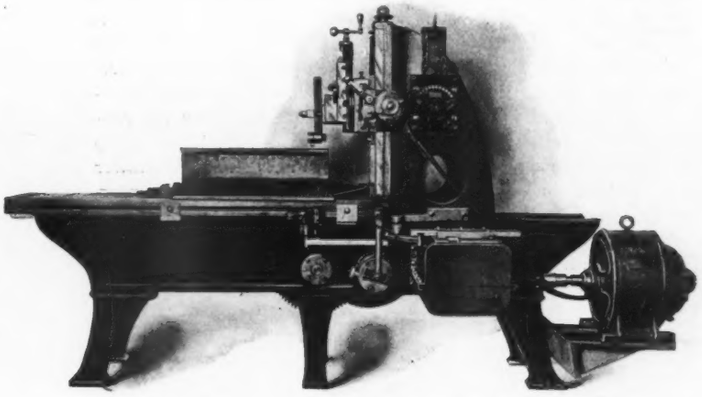


FIG. 1.—MOTOR-DRIVEN PLANER WITH REVERSING MECHANISM.

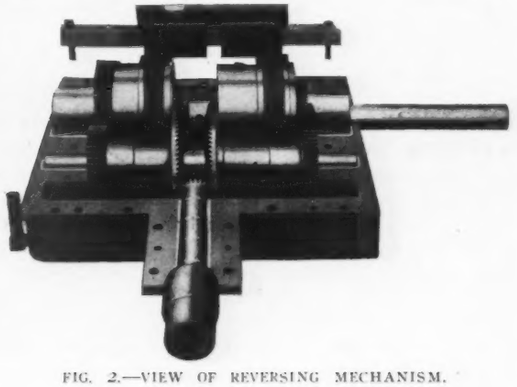
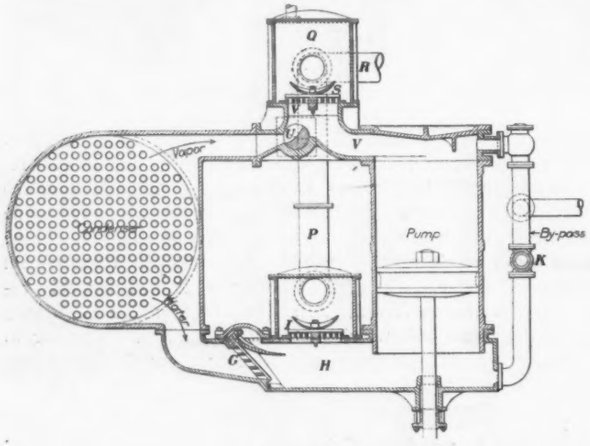


FIG. 2.—VIEW OF REVERSING MECHANISM.

High Vacuum Pump for Condenser Use.

The accompanying illustration shows a new type of combined hot-well and vacuum pump which is being built for a 20,000,000-gal. vertical triple-expansion pumping unit now under construction for the water works of an Eastern city. It was designed by Mr. Charles A. Hague, of New York City. The arrangement of pump cylinder, valves, discharge pipe and the connections to the condenser are clearly shown. The upper passage from the condenser is a suction for drawing off vapor and air from the upper part, and the lower passage is for water. The valves at *G, I* and *S* are simple rubber flap valves, as shown, or may be of the ordinary rubber disk form, while that at *U* is mechanically operated. A by-pass runs from one end of the pump cylinder to the other, and is controlled by the valve *K*. *P* is the discharge pipe for water, connecting with the line *R*. The chief feature of the pump is the method of securing a perfect vacuum at the upper end of the pump cylinder, in order to increase the quantity of vapor and air withdrawn from the condenser and secure a higher vacuum in the latter. If the pump piston is assumed to be at the upper end of its stroke, the lower end of the cylinder and passage *H* are partly filled with water, which is expelled through the valve *I* on the downward stroke, some of the water at the same time being forced through the by-pass and into the upper part of the cylinder. As soon as the down-stroke commences the mechanically operated valve *U*



VACUUM PUMP.

opens, drawing vapor from the condenser. When the piston starts to return, the valve *U* closes and the vapor, together with some of the water, is forced out through the valve *S*, while the lower part of the cylinder draws water from the condenser through valve *G*. The water forced through the by-pass to the upper part of the cylinder plays its part on the up-stroke, for a sufficient quantity is allowed to pass over, by properly regulating valve *K*, to fill the vapor passages *V* completely and cause some to be expelled through valve *S* so that when the piston starts downward and the valve *U* opens the passages are completely filled with flat condenser water, and a perfect vacuum would result if *U* did not operate. The net power required to run the pump is about the same as would be required for other pumps doing the same service, but it is expected that it will increase the vacuum about 3 in. over the ordinary condenser in every-day practice, with a minimum use of condenser water. There is thought to be no danger of the high vacuum running down, since the only regulation required is the setting of the valve *K*, for controlling the amount of water going through the by-pass to the upper part of the cylinder, and this can be properly determined after a few trials. The pump can be used either vertically or horizontally, and for surface, spray and barometric condensers. For use in steam-turbine plants, drives have been devised for operation directly from the turbine shaft, by means of a worm; and for individual motor drive, in the latter case the pump and motor bases being cast as one.

All-Metal Telephones.

The telephone shown in the accompanying illustration is of the automatic switchless type. It consists of a telephone in an all-metal stamped-steel case that is composed of a base with knock-out rings at the top and bottom for the insertion of

FIG. 1.—ALL-METAL TELEPHONE.

cable; the cover clips on to the base without the use of any screws, hinges, lock, etc.

The instrument can be used for metallic circuit or common return and has the self-contained hook, ball-bearing mechanism; all movable parts in the telephone are interchangeable. All of the connections are made by means of screws and are completed

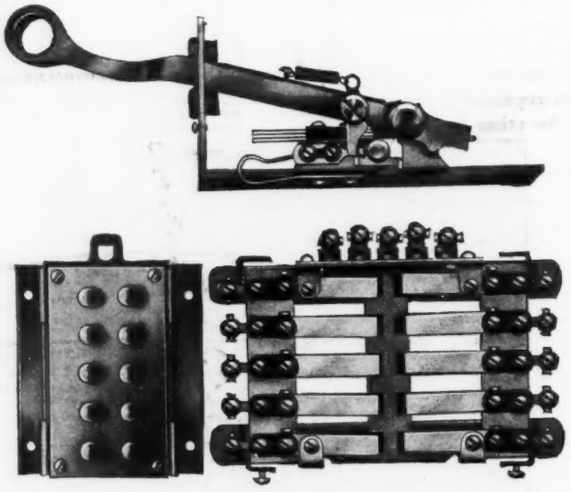


FIG. 2.—ALL-METAL TELEPHONE.

inside of the telephone. The line wires are led into the rear of the telephone through fiber bushings. No wood is used in the telephone, and it is claimed to be practically indestructible. The all-metal telephone is made by the De Veau Telephone Manufacturing Company, 427 Eighteenth Street, Brooklyn, N. Y.

Lamp-Cord Adjuster.

The Gem Manufacturing Company, Milwaukee, Wis., has recently placed on the market a new lamp-cord adjuster. The essential parts of this adjuster are a U-shaped hanger, a 3-in. grooved wheel, which is provided with a coiled expansion spring, and a cord which winds around the drum of the wheel and attaches at one end to the drop wires. The wheel is also provided with a catch and trip of the rolling-curtain type.

Auto-Starter with Circuit-Breaker Protection.

The Hartman Circuit Breaker Company, of Mansfield, Ohio, has recently brought out an improved auto-starter for two-phase and three-phase induction motors. The unique feature of this starter is that it affords automatic protection, both overload and low-voltage, and thus dispenses with the usual circuit-breaker. The overload protection is usually provided only for the running side, but if desired, the starting side can also be connected in such manner so that about one-fourth of the turns

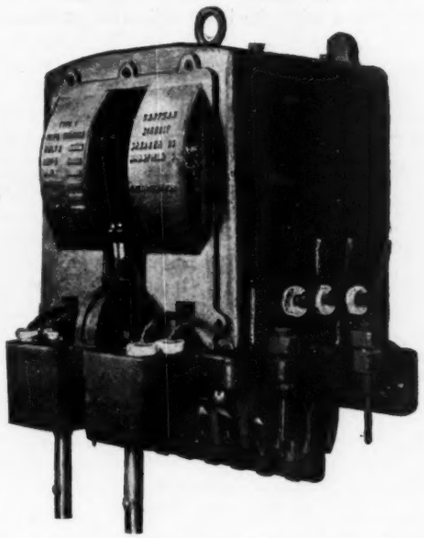


FIG. 1.—WALL MOUNTING, THREE-PHASE AUTO-STARTER WITH OIL TANK REMOVED.

of the overload coil are in series. This gives complete protection against overload and short circuit. The starter is made six-pole, with six contact points on both starting and running sides. By using this number of contacts the auto-transformers are cut out when the switch is thrown to the running side, thus relieving the transformer coils of all potential strains except during the period of starting the motor. In starting the motor the operating handle is brought down midway and must be held at this point. Should the operator let go of the handle the switch will immediately return to the off position. This

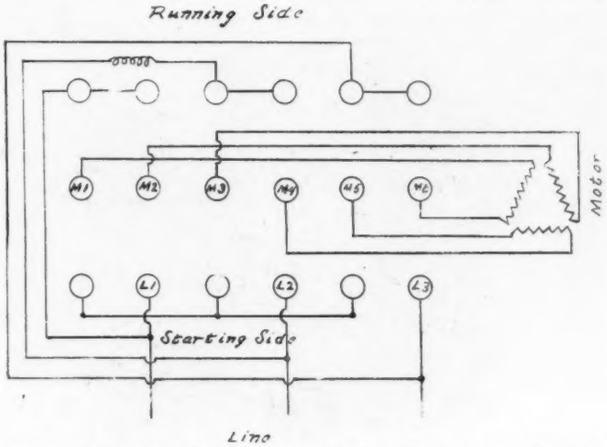
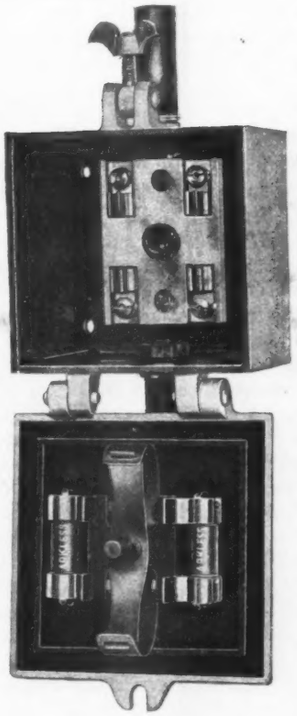


FIG. 2.—DIAGRAM OF CONNECTIONS FOR STARTING VOLTAGE WITHOUT USE OF AUTO-TRANSFORMERS OR COMPENSATOR.

feature renders it impossible for a careless or inexperienced operator to go off and leave the switch in the starting position. When the motor has speeded up sufficiently the trip lever is raised, allowing the handle to be thrown on to the running position where it is securely locked. Laminated contacts are used on the running side, which are protected by heavy arcing contacts. Both laminated and arcing contacts are made easily removable without disturbing the leads. The starters are frequently furnished for star- and delta-connection, in which case the transformer case and coils are omitted, and the cost of the installation can be reduced over one-half by this method. In the case of a three-phase motor, whenever six leads can be carried from the motor to the starter, a starting voltage the equivalent of 57.8 per cent of the running e.m.f. can be obtained by making the connections shown in Fig. 2. The phase windings of the motor are not permanently joined together, but are brought to the starter and three of the leads are arranged in star-connection for starting and in delta-connection for normal running. For motors of from 5 hp to 30 hp a smaller starter has been developed especially for the star- and delta-connection. This starter is provided with either overload or low-voltage protection, or both.

Fused Switches

The Detroit Fuse & Manufacturing Company, of Detroit, Mich., has brought out a line of ironclad fused switches which embody an entirely new knife-switch mechanism. This mechanism is controlled by a plunger from the outside of the box, making it possible to open and close the circuit without opening the box. Many advantages are claimed by the manufacturer. The box may be sealed, thus preventing the theft of electricity or tampering with fuses, while at the same time the switch can be thrown on and off as desired. The new mechanism provides a quick make and an equally quick break, there being no intermediate position of the switch. The spring is sufficiently strong to throw the switch either on or off independent of other pressure. It is impossible to make contact by closing the cover, since an extension on the plunger engages a lug in the base, thus preventing the knife blades from approaching the terminals in the box. It is also impossible to break the circuit by opening the cover, since when the switch is in the "on" position the plunger projection extends into the lug in the base and can only be removed from this position by means of the quick-action spring mechanism. A blown fuse is readily replaceable without danger of shock or without the operator touching or coming into close proximity with any live part of the circuit; but it is impossible to replace a fuse without first actuating the switch to its "off" position. It will be noticed from the accompanying illustration that the fuses are mounted between the knife blades of the switch and on a fiber cross-bar controlled by the plunger. The mechanism consists of two springs, one a large bow spring in which a smaller spring is inserted. The latter is either in a concave or convex position thereby throwing the knife blades into or out of the jaw terminals in the porcelain base.



FUSED SWITCHES.

A portion of the cast-iron box extends through the porcelain base, the center of this being drilled to accommodate the plunger projection, thereby preventing the cover from being opened or closed when the switch is in the "on" position. The manufacturer claims the box to be foolproof, fireproof and dustproof, and has designed it especially for motor control and entrance work, where a switch will be subjected to severe usage.

Torque Characteristics of Alternating-Current Motors.

The greatest difficulty attending the use of alternating-current motors upon lighting circuits is in the disturbance produced at the moment of starting. Polyphase motors of the squirrel-cage type usually take from three to eight times normal current at the instant of starting, when full normal torque is required, and since this current is at low power factor considerable disturbance will result unless the feeder and transformers are both of ample capacity. In the accompanying diagrams Fig. 1 shows the relation of starting current to starting torque for various types

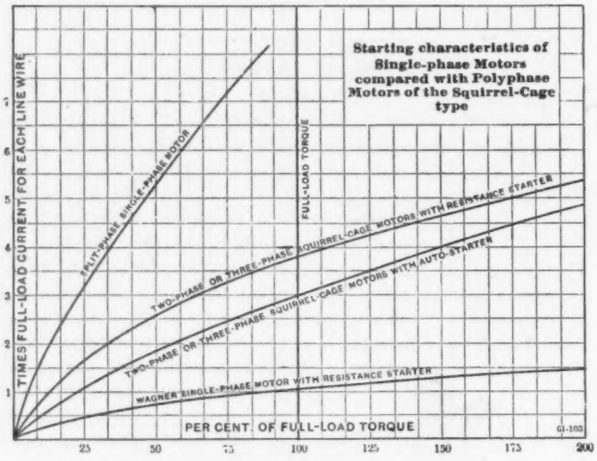

Starting characteristics of Single-phase Motors compared with Polyphase Motors of the Squirrel-Cage type
TIMES FULL-LOAD CURRENT FOR EACH LINE WIRE
FULL-LOAD TORQUE
SPLIT-PHASE SINGLE-PHASE MOTOR
TWO-PHASE OR THREE-PHASE SQUIRREL-CAGE MOTORS WITH RESISTANCE STARTER
TWO-PHASE OR THREE-PHASE SQUIRREL-CAGE MOTORS WITH AUTO-STARTER
WAGNER SINGLE-PHASE MOTOR WITH RESISTANCE STARTER
PER CENT. OF FULL-LOAD TORQUE
25 50 75 100 125 150 175 200

FIG. 1.—STARTING CHARACTERISTICS OF VARIOUS TYPES OF MOTOR.

of alternating-current motors. It will be noted that the best results in the matter of starting and line disturbance are claimed for the Wagner single-phase type, and that full normal starting torque may be obtained at approximately full-load current. The curves relate to actual starting condition, and give no clue as to the variation of torque with the change in rotor speed. The change in torque of the Wagner single-phase motor, with and without a starting box, is shown in Fig. 2. It will be noted that a current 2.5 times normal is obtained at the instant of starting, but the current decreases rapidly to normal at full-load speed. The time required under the usual conditions for the motor to attain full speed is said to be from 8 seconds to 12 seconds, so that the circuits can be fused for full protection without danger of blowing the fuses at the instant of starting.

The Wagner motor is so constructed that it can be used without any form of starting device, a switch being used for opening and closing the circuit when desired. When no starter is employed the current at the first instant of starting, as well as the torque, will be approximately 2.5 times the normal. Under these conditions the circuits can safely be fused for 1.25 times normal current, the motor attaining speed before the fuse becomes overheated.

The actual currents per line wire for full-load starting torque in certain motors wound for 220 volts is shown in the following tabulation:

	5 hp.	7½ hp.	10 hp.	15 hp.
Three-phase squirrel-cage with auto-starter, amp.	54	80	105	140
Two-phase squirrel-cage with auto-starter, amp.	50	75	98	132
Wagner single-phase without starting box, amp.	45	68	90	125
Wagner single-phase with starting box, amp....	33	50	65	90

It is interesting to note in this tabulation that the starting currents required for single-phase motors, without starter, are favorable as compared with polyphase motors giving equal starting torque, and that when a starter is employed the advantage in the matter of line disturbance is much in favor of the single-phase type for the same starting torque.

It will be recalled that the Wagner single-phase motor is an induction machine having a commutator mounted on the rotor shaft and connected to the rotor winding. Starting with the machine at rest, brushes in pairs, cross-connected through a low-resistance conductor, bear upon the commutator, temporarily short-circuiting the rotor winding and developing a large starting torque on the "repulsion" principle. On attaining full-load speed, by the operation of an automatic centrifugal governor the individual segments of the commutator are all positively connected together, thereby transforming the rotor winding to the squirrel-cage form; the motor then continues to operate as an induction type machine. The governor at the same time removes the brushes from contact with the commutator, thereby saving wear.

A view of a 20-hp Wagner single-phase motor, showing the radial commutator with the brushes in the starting position, is given in Fig. 3.

It is said that no harm can be done to the Wagner single-

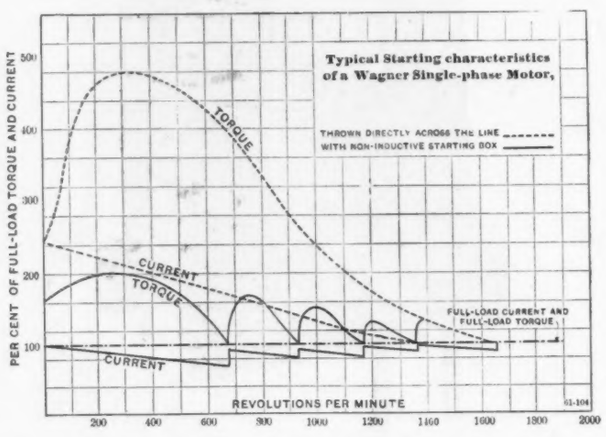

Typical Starting characteristics of a Wagner Single-phase Motor,
THROWN DIRECTLY ACROSS THE LINE
WITH NON-INDUCTIVE STARTING BOX
PER CENT OF FULL-LOAD TORQUE AND CURRENT
TORQUE
CURRENT
TORQUE
CURRENT
FULL-LOAD CURRENT AND FULL-LOAD TORQUE
REVOLUTIONS PER MINUTE
200 400 600 800 1000 1200 1400 1600 1800 2000

FIG. 2.—CURVES SHOWING CHANGE IN TORQUE OF THE REPULSION MOTOR.

phase motor by suddenly interrupting, or without the intermediary of resistance suddenly re-establish the circuit at any stage of the cycle of its operation from rest to full speed, irrespective of load conditions. If the supply should fail for any reason, the motor returns to the starting condition, and picks up its load when the service is returned, without the assistance or attention of anyone.

The single-phase motor just described is built by the Wagner

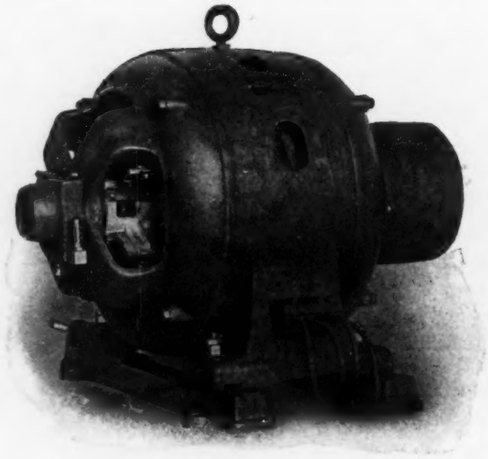


FIG. 3.—SELF-STARTING SINGLE-PHASE MOTOR.

Electric Manufacturing Company, St. Louis, Mo. This company also builds a similar motor for variable-speed work. This machine differs from the constant-speed motor in that its commutator remains in service at all times. Wide speed variation is obtained by varying the voltage applied at the stator terminals, the torque at any speed varying with the square of the applied e.m.f.

Meter and Service Box.

The Rochester meter and service box, illustrations of which are shown below, is so designed as to combine a service-entrance box and meter board having many advantages. The box, being sealed and therefore inaccessible to any other than authorized inspectors of the lighting company, the underwriters will allow the use therein of link fuses, which are very much cheaper than enclosed fuses, and as the fuses in service boxes are generally furnished and maintained by the company this feature alone means a considerable saving each year. As the box is sealed the underwriters will require the consumer to install a switch and cut-out on the house side of the meter and if the service box is fused a little higher than the consumer's main-cut, the company will be troubled very little with the link fuses in the service box blowing. On the other hand, if the consumer places copper wire in his cut-out, the house lines are still protected by the fuses in the company's service box. The service box is so designed that in case the company's inspector wishes to test or change the meter, after breaking the seal, he has merely to insert two common plugs and open two copper links when the meter is disconnected and can be tested or replaced with a new meter without interrupting the service of the consumer. The plugs which are used to bridge or by-pass the meter are provided with handles of such length that the door of the service box cannot be shut until the plugs are removed, thus making it impossible for an inspector to close and seal the box and leave the meter bridged. With the use of this box it is absolutely impossible to obtain access to a wire on the service side of the meter without breaking the seal, thus effectually preventing the theft of electricity.

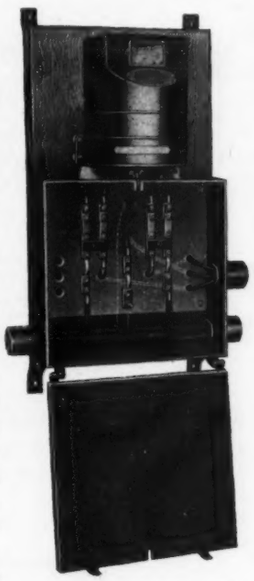


FIG. 1.—METER AND SERVICE BOX.

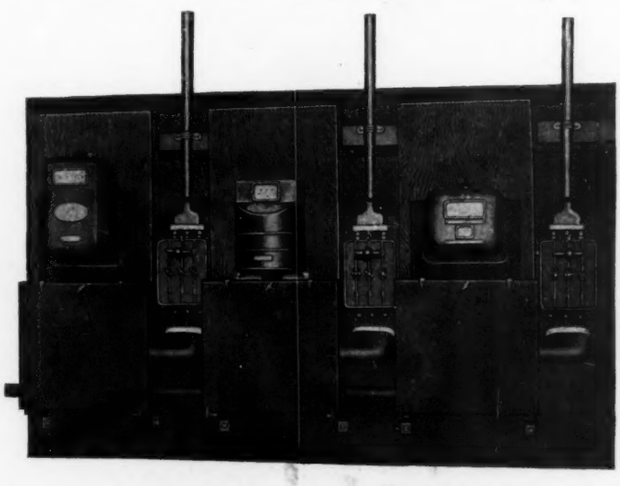


FIG. 2.—METER AND SERVICE BOX.

The meter and service box is standard for all makes of meters, as a special gutter is furnished for any make or type of meter, these gutters being interchangeable. In case a consumer's service is discontinued, the meter may be removed and the service box sealed, thus leaving the service box and meter board ready for the installation of a new meter if at some later date the consumer calls for a reintroduction of service, at the same time preventing theft of electricity while the meter is out. Owing to the simple method of bridging the meter and connecting instruments and artificial load without interrupting the consumer's service, a tester, it is claimed, can test at least 25 per cent more meters per day than is possible where meters are installed in any other manner. The meter and service box is manufactured by the Ricker Manufacturing Company, of Rochester, N. Y.

A German Roentgen-Ray Outfit.

The Emperor of Germany, who is always interested in new technical apparatus of every kind, has ordered from the Siemens & Halske Company, Berlin, a 25-in. X-ray coil and complete Roentgen outfit for a hospital in Szittkehmen, near his Castle Rominten. A gasoline motor of 4½ hp is used for driving a dynamo generating 20 amp at 65 volts. With this dynamo a storage battery of about 30 amp is charged, from which the current for actuating the induction coil is taken. The battery also serves to furnish energy for about 20 tantalum lamps. The motor can also be used for driving a Siemens-Schuckert rotary pump for pumping water into a tank at the top of the house. The Emperor and the Empress witnessed the operation of the plant a few weeks ago and expressed themselves as much pleased with its excellent working.

New Cartridge Enclosed Fuse.

The Trio Manufacturing Company, Rock Island, Ill., has placed on the market, through the Crescent Company, Chicago, Ill., a new enclosed fuse of the cartridge type which can be made in any desired capacity and may be used wherever other types of cartridge fuses are employed. It consists of two contact metal end pieces and a "filler." The contact pieces, which do not vary in appearance from the caps ordinarily used on enclosed fuses, fit over the ends of the filler and are provided on the inside with copper jaws which engage with the ends of the fuse. The filler is composed of a paper cartridge in which is located a hard-metal fuse. The fuse wire extends through into the caps, and there engages with copper jaws provided in the contact ends. When the fuse wire is blown another filler may be inserted in the original contact caps at small expense.

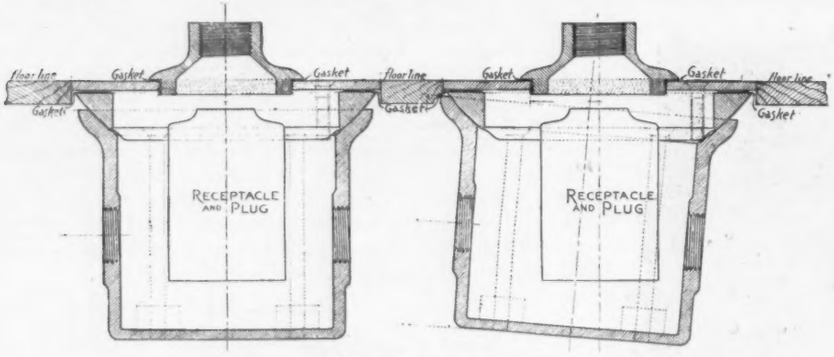
Tungsten Shade Holder.

The Dale Company, of New York City, has brought out an exceptionally simple tungsten shade holder. The device, which is shown herewith, is practically made of one piece, no screws whatever being used. It is quickly and readily attached to both the socket and the shade, being securely held to the former by means of a catch and to the latter by means of a spring clamp. The method for attaching the shade will be readily apparent by reference to the illustration, the base being clamped around the shade by means of the wire ring.

TUNGSTEN SHADE HOLDER.

Floor Box and Receptacle.

The new floor box shown in the accompanying illustration, made by the Federal Electric Company, Chicago, is a simple and compact device, being only 4 in. deep and 4 in. in diameter. The principal feature of its design is a perfect vertical and angular adjustment which permits the floor plate to be set exactly level and flush with the floor and assures it remaining that way permanently. The vertical adjustment permits of raising or lowering of the floor plate and maintaining it at any desired level. The angular adjustment is made and maintained by three screws, permitting the plate to be set level in case the box is installed at an angle. No extra parts are needed for installing, thus making this operation very simple. Gaskets under the flange of the nozzle, between it and the floor plate, and also between the floor plate proper and plate giving the angular adjustment, insure water-tight joints. The box itself is a one-piece casting. The floor plate is of brass, highly polished on the upper surface.



FLOOR BOX AND RECEPTACLE.

Stationary Tachometer.

A new line of stationary tachometers has just been put on the market by Schuchardt & Schutte, of New York. The line comprises stationary tachometers of both the vertical and horizontal types, for belt connection as well as for direct connection to the shafts of steam turbines, launch engines, centrifugal engines, etc., and also tachographs for continuously recording the revolutions, rates and running time of machinery of all kinds. They are based on the action of centrifugal force on weights pivoted on a rotating spindle. The movement of the weights when rotating is controlled by gravity or by springs, and is indicated by a pointer mechanically connected to them. The pointer at any moment indicates the exact position of the rotating weights. Both the tachometers and tachographs are made in a number of different sizes to meet all conditions, and are furnished for any desired ratio of speed. They are, when required, supplied with gear boxes, so that the spindles can be directly connected to driving shafts of other revolution rates than those furnished as standard for the different types. Another feature that renders these instruments universally applicable is the arrangement of electric alarm contacts for sounding warning bells, or for automatic speed regulation, such as is frequently essential in the operation of gas engines, when the speed rises or falls beyond any predetermined value. Auxiliary pointers are also furnished which indicate the maximum speed at which the shaft has been running at any time. The tachographs are composed of a tachometer and a recording mechanism, with clockwork drive and a recording strip. The curve is drawn in ink by a recording pen on a paper strip wound from one roll to another automatically. These instruments can also be supplied with clockwork drive, arranged to traverse the paper at various speeds per minute. The recording strips are ruled with horizontal lines for speeds and upright lines for time. The lines are marked with the corresponding revolution or time rating.

Flexible Strap Toggle.

The accompanying illustrations show two flexible strap toggles and their applications; the one for securing moldings and the other for fastening conduit to walls. The devices are manufactured by the Conlan Electric Company, New York City, and possess the advantage of greatly reducing the labor cost of fastening molding to hollow ceilings and walls, where nails or screws cannot be used. All that is necessary is to bore ¼-in. holes, insert the strap toggle through the molding and the ceiling, or other surface, to which it is to be attached in one movement, bend over the strap and drive the necessary nails. The strap being very thin, countersinking is eliminated, the cap of the molding fitting over the strap without gouging. The wire toggle support, shown in Fig. 2, possesses the strength and rigidity of a toggle bolt, at the same time reducing the necessary operations to drilling, inserting the toggle and twisting the wire around the pipe as indicated.

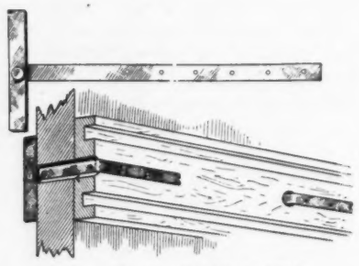


FIG. 1.—STRAP TOGGLE.

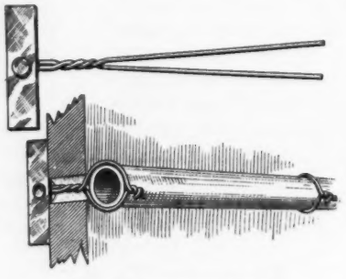


FIG. 2.—WIRE TOGGLE.

Weatherproof Fuse and Disconnecting Switch.

The accompanying illustration shows a high-tension weatherproof fuse and disconnecting switch, consisting of a fuse chamber, arc chute, fuse holder and disconnecting switch, all the elements being self-contained and so designed as to be directly mounted on an ordinary cross-arm without alignment. The disconnecting switch is mounted on a heavy porcelain insulator and the other elements are contained in a heavy, specially designed, petticoated weatherproof porcelain chamber attached to a galvanized-iron support adapted for mounting on standard cross-arms.

The fuse holder proper is provided with an insulating handle in the end of which is located a pin which engages a bayonet lock in the fuse holder, in turn provided with a secondary locking device which, after the fuse holder is forced into the fixed contacts, holds the fuse in position. The handle is then removed, leaving the fuse in series with the line and preventing unauthorized persons from tampering with it.

The fuse is of the expulsion type, being so designed that its lowest melting point is within a metallic expulsion chamber

which receives the shock and at the same time collects the gas, the explosive action of which expels the heated gases through properly located port holes.

By the use of the disconnecting switch a lineman can safely replace a blown fuse, although the disconnecting switch is not intended for opening a circuit under load.

It is said that a long series of tests on a transmission system

WEATHERPROOF FUSE AND DISCONNECTING SWITCH.

were made before the final design was adopted, and that while the present limitations are 13,200 volts at 15 amp, experiments under way indicate that the limits can be carried considerably higher.

The above fuse is being placed on the market by the Central Electric Company, Chicago, Ill.

Multiple Tungsten Fixture.

While the special office of the tungsten lamp is to afford a high-efficiency unit of low candle-power for frequent spacing over large areas to give a better light distribution, many lighting problems involve large spaces with high ceilings, where fixtures containing single lamps would appear insignificant. In many other places, too, such as large department stores, halls, etc., at present illuminated with arc lamps, tungsten lamps can be used with economy and the present wiring need not be disturbed or the number of outlets increased. It is for these purposes that the Wheeler Reflector Company, of Boston, Mass., has designed three special fixtures, one of which is shown herewith. The slightly concave porcelain enameled steel reflector and the convex deflector inside the globe form a concave channel around the inside of the fixture immediately above the lamps which intercepts the upward radiated light and directs it toward the tip, while the horizontal light is radiated directly outward without interference, giving practically a uniform candle-power in all directions in the lower hemisphere. Especial attention is drawn to the diffusing globe, which follows the outline of the bulbs of the lamps enclosed. The bottom is concaved at the center, at which point the globe is supported by a holder placed so high above the bottom of the globe that no shadows are cast.

MULTIPLE TUNGSTEN FIXTURE.

This fixture has a waterproof housing for the sockets and connections, and is also arranged so that it may be fitted to a gooseneck or crook on an ornamental iron post, or fitted for use with series sockets, either with or without the diffusing globe, and provided with cross-arms, insulating joints, etc., essential to street series constructions.

Incandescent Electric Desk and Table Lamps.

Proper illumination of desks is a problem which has never been satisfactorily solved. Most of the lamps used for this purpose consist of an ordinary incandescent lamp-bulb placed in a small reflector, which throws nearly all of the light on one section of the desk and leaves the balance of the desk insufficiently lighted. As an improvement over this system, the H. W. Johns-Manville Company, New York, has brought out a line of desk lamps known as "Linolite" desk lamps. While the design of these lamps is somewhat different from others now on the market, their novel feature is in the lamp. Instead of the ordinary bulb lamp generally used, the tubular Linolite lamp, here shown, is employed. This tubular lamp is 12 in. long between centers and, therefore, distributes the light more evenly and over a larger area of the desk than bulb lamps. Its filament is stretched out straight from end to end and lies throughout within the focus of the reflector. As the filament of a lamp throws its greatest light at right angles to its axis, the lamp naturally gives more useful light than bulb lamps, whose filament cannot lie in the focus of a reflector on account of being coiled. The lamps are made in various finishes.

FIG. 1.—LINOLITE DESK LAMP STANDARD.

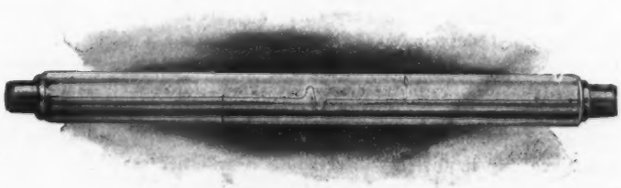


FIG. 2.—LINOLITE LAMP.

Contact Coupling for Arc Lamps.

Fox Brothers & Company, New York City, are placing on the market the contact coupling shown herewith. This is made of a special pulley fitting at the top, a fixed clutch part in the center and a lower contact part. The main body is made of vitrified porcelain in which the clutch mechanism is securely mounted. The coupling permits of raising and lowering arc lamps without the necessity of any flexible conductors. The lamps can be installed at considerable heights and lowered for trimming, the circuit wires only going to the main body portion,

CONTACT COUPLING FOR ARC LAMPS.

which can be securely fastened to the ceiling or any other suitable place. A number of special pulleys are provided for fastening on poles, I-beams and ceilings. The clutch is strong and simple, and the contacts are made of non-corrosive spring metal. The contact portion is so made that the polarity of the wires cannot become reversed, and needless to state ample metal is provided for carrying the necessary current. When the lamp is pulled up in position the clutch catches and the lamp is secured without any strain on the lowering cable. To lower the lamp a slight pull is first given to the cable which suffices to release the clutch, when the lamp may be lowered by paying out the cable in the usual manner.

Tank and Sump Switch.

In the first issue of January there appeared in these columns an illustrated description of a tank and sump switch manufactured by the Sundh Electric Company of New York City. Owing to a typographical error the name of the manufacturer of this interesting piece of apparatus was given as the Smith Electric Company. No such company exists in New York City, and since any inquiries addressed to it will necessarily be returned to the sender, these should be re-addressed to the Sundh Electric Company.

Electrical Exhibits at the Boston Motor Boat Show.

Electricity played a most prominent part at the recently held Boston Motor and Power Boat Show. The gasoline motor naturally occupied the center of the stage, but in the field of auxiliary equipment and in the operation of exhibits, the advertising of displays, and in facilitating communication electricity was the most extensively employed agent. The show was under the management of Chester I. Campbell, of Boston, and was located in the Mechanic's Building on Huntington Avenue, in the Back Bay district.

The Gordon Auto Supply Company, represented by H. Disner, exhibited the Remy magneto, the Eisner timer and distributor, switch and coil, and spark plugs. The magneto shown was of the inductor type, with no moving contacts or wire. A single coil of No. 18 wire is imbedded in the pole pieces of the magneto, and the rotor consists of a simple forging mounted on a steel shaft. This company also showed the Geiszler non-sulphating storage battery, specially used for motor boat ignition. This battery is provided with perforated hard rubber and wooden separators; the compartments of the cells are sealed by an inner hard-rubber cover and sealing compound; and vents are provided to allow the free escape of gases, and by an indirect opening, to prevent both evaporation and the spilling of acid. Corrosion has been eliminated by the use of heavy silver-plated screws in the binding terminal posts. A small hand-book of ignition troubles was distributed at the booth.

The A. S. Morss Company, Boston, showed a large variety of fittings, including a waterproof battery set, the Morss control lever for leading spark and throttle controls to any part of the boat, and coils. The cells in the company's waterproof boxes are connected and flooded with waterproof composition of insulating character. The spark coils are similarly imbedded. The company also showed the Hermetic battery case for dry cells of the removable type. A water-tight gasket is provided for the cover, and the spaces between the cells are filled with waterproof composition, the cells being held in place by spring blocks. The company also showed the Morss lighting outfit to facilitate engine adjustments at night. The outfit consisted of a waterproof battery set and 4-cp reflector lamp protected by a wire cage and provided with a pull chain for current control. The Stayfast connector was shown, with provision for turning the edge of the metallic contact leaf against the face of a binding post nut, preventing the backing off of the nut until the edge is again turned down flat. The company was represented by G. S. Campbell.

The Fore River Shipbuilding Company, of Quincy, Mass., made a display of parts of Curtis turbines for marine service, crank shafts, forgings, water-tight electrical connections with glass tube fuses for marine work, photographs of the company's yards and shops, and miscellaneous marine equipment turned out in the execution of government contracts. Messrs. Browning and Simons represented the company.

Howe & French, Boston, exhibited the Duro dry storage battery, provided with a copper case, Duro plate and electrolyte steel bottom and lead lining.

The Fairbanks Company, New York, exhibited a direct-connected gas engine set running on city gas and furnishing current for the lighting of a large electric sign. The exhibit was in charge of M. W. Carsley.

The K-W Ignition Company, Cleveland, displayed a magneto and spark coil, the magneto being run continually under water without injury. This machine is of the inductor type, without brushes, commutator or moving wires, and requiring no mechanical governor. Ball bearings, waterproof housing and quadruple magnets capable of lifting all told 25 lb. are the special features. The company was represented by J. A. Williams and W. J. Forbes.

The Acme Wireless Construction Company, of Cambridge, Mass., exhibited two wireless telegraph stations in operation in the hall, and displayed a variety of commercial apparatus for sale, from amateur equipment upward. C. E. Russell represented the company.

The Richardson Engineering Company, of Hartford, Conn., exhibited storage batteries, independent gasoline electric generating sets for yacht and factory lighting, engine telegraph apparatus, and arc searchlights, with switchboards for marine service. The generating sets were rated at from 5 hp to 20 hp.

110 volts. The smaller switchboards are built with slate of enamel finish, which is non-absorptive of oil and more readily cleaned than marble. Meters, an automatic storage battery charging switch, electric yacht lamps, and miniature lamp outfits were shown. A special exhibit was a new automatic storage battery charging box. This apparatus resembles an ordinary spark coil, being a wooden case of about the same size. Inside, sealed in, are a voltmeter and ammeter, a charging switch and a control switch with controlling lever on the outside. A fuse is provided with terminals for taking readings of the current and voltage. The engine telegraph exhibited is electrically operated, with dials resembling the standard mechanical telegraph, but when the apparatus is worked the instrument rings a bell in the engine room, turns on a light in a sector wanted, and indicates at the sending station that the signal has been received. When the handle is released the light is extinguished, but the drop remains down in the proper sector until a new signal is given. The company was represented by D. A. Richardson and A. C. D. Loucks.

The Percy Ford Company, Boston, exhibited the Reliance spark plug, operating under water. The insulated sparking point in this device is a fine platinum wire baked in and brought flush with the surface of a porcelain insulator. Under the cap is a small pellet of high resistance material which serves the purpose of an air-gap in series with the spark-gap. The company was represented by A. H. McIntyre.

The Charles J. Jager Company, Boston, exhibited direct-connected gasoline engine generator sets of from 3 kw to 6 kw, for lighting and power service generally, with Holtzer-Cabot generators and Apple ignition dynamos. Representatives present were C. J. Jager, R. N. Stewart and C. O. Rogers.

The Westchester Appliance Company, represented by J. H. Cooper, showed the dry battery made by the company. The initial voltage of this cell is stated as 1.6, with claims of long life and recuperative powers.

The Oswell Igniter Company, Boston, displayed a moisture, heat and waterproof igniter, with a vibrator and condenser in separate equipment.

The Motsinger Device Manufacturing Company, of Pendleton, Ind., exhibited a plug switch without a swinging arm, encased in a moisture-proof box. This apparatus consists essentially of phosphor-bronze springs and the plug, the number of parts being a minimum. An automobile and motor-boat sparker and charging board of pocket size were also shown, equipped with a plug switch, and combination volt and ammeter. The company was represented by P. J. Dasey.

The American Electric Fuse Company, of Muskegon, Mich., showed a compact form of igniter, combined with a coil, timer and distributor in a single structure. This igniter consists of a case containing a hollow coil, within which is a shaft carrying a timing device and a distributor. The case is made of vulcanized fiber that is heat and dustproof, with an aluminum base. The secondary coil is made up of fiber spool wound in 12 sections, separated from each other by 1/16-in. partitions. The secondary coil can easily be removed. The igniter operates on 0.5 amp to 0.7 amp at 6 volts. The platinum point of the timer is carried on a spring plunger, to make it impossible to ruin the contact points by careless adjustment. The igniter runs on a double set of ball bearings. The company was represented by R. W. Augustine.

The Chicago Coil Company exhibited spark coils of the cartridge type for jump spark and make-and-break service. Non-absorbent enameled wire is used in these coils, with interchangeable parts. The company also showed an iron-clad igniter of waterproof type. "National" batteries of the storage type were also handled by this company.

Byrne-Kingston & Company, of Kokomo, Ind., represented by Geo. Kingston, showed an automatic carbureter.

F. D. Lawley, representing the F. A. Brownell Motor Company, of Rochester, N. Y., showed a Brownell electric generating outfit of 5 kw, consisting of a Rochester dynamo direct driven by a Brownell four-cycle, four-cylinder gasoline motor, for general marine and isolated lighting service.

The National Carbon Company, of Cleveland, exhibited a full line of dry batteries for all kinds of service, various styles of high-efficiency lamps for automobile and motor-boat service, and an apparatus for analyzing the operations of ignition circuits. This equipment showed the current consumption from a battery by coil and timers, the length of contact of various kinds of timers, the actual number of sparks given in a given time, the synchronism of the timing, speed of the vibrator, regularity of action of the vibrator, and the reliability of contacts on timers. The company was represented by J. C. Irvine and A. L. Haskell.

The Kingston coil was exhibited by the Kokomo Electric Company in various types. Special switches were also displayed, with magneto coils and vibrators.

C. F. Splitdorf, New York, showed a large variety of spark coils, magnets and spark plugs. This house was represented by Rohde Brothers, who have just opened a branch in Boston at the Motor Mart.

The Stuart-Howland Company, Boston, exhibited spark plugs, detachable terminals, spring terminals, copper gaskets, flexible cable, connectors, switches, marine switchboards, testing instruments, timers, distributors, coils, igniters, magnetos, charging dynamos, batteries, fan outfits, electric whistles, lamps, tools and other electrical supplies useful in motor boating. The company was represented by R. M. Merritt.

The Hoyt Electrical Instrument Works, of Penacook, N. H., showed a full line of accurate ammeters, voltmeters and volt-ammeters for ignition testing. The company was represented by Dr. A. H. Hoyt and Mr. W. C. Hoyt. The moving systems of these instruments operate in jeweled bearings, and the coils are located in a strong permanent field. They indicate the conditions in the ignition system during the whole time that the circuit is closed.

The Eastern Carbon Works, of Jersey City, N. J., exhibited dry batteries and connectors, in varied sizes, from 1½ in. to 8 in. in diameter, and also the "Eastern" gas engine battery in a square carton, for improved compactness when in operation on motor vehicles. The company was represented by Oliver L. Turgeon.

The Burn-Boston Liquid Battery Company showed three sizes of ignition cells, and the Klaxton horn, electrically operated. Mr. M. H. Stearns represented the company.

The Waterman Marine Motor Company, of Detroit, Mich., exhibited a 0.5-kw marine lighting set with a generator direct driven by a two-cycle Waterman gasoline engine. Messrs. Miller and Homer represented the house.

The American Storage Battery Company, of Boston, showed the Harvard igniter and low-voltage batteries for sparking service. These were shown in both single and twin sets for convenient operation, with a submarine boat. Metallic and wooden cases were provided. The company was represented by Arthur P. Homer, of Boston.

Stanley & Patterson, New York, exhibited wireless battery holders, making it possible to carry in one solid molded-rubber composition plate as many battery units as the conditions require. The cells are fitted at their terminal ends with a screw thread just the same as an incandescent lamp. No binding posts are required. The cells are connected-up by being screwed into the rubber plate. The company was represented by Mr. Clifton F. Draper.

A. Hall Berry, of New York, also showed a wireless battery box.

George Lawley & Son Corporation, Boston, showed a marine electric generating set. The company was represented by Fred Lawley.

The Murray & Tregurtha Company, South Boston, showed a Baxter switchboard made by W. H. Baxter, Somerville, Mass., battery charging rheostat yacht lighting equipment, and Chlorine accumulators. It was represented by J. W. Card.

The Electric Goods Manufacturing Company, of Boston, showed the apparatus of the Apple Electric Company. The company showed yacht and motor-boat switches, water-tight switches, Apple dynamos and coils. The company was represented by Messrs. Snell, Ross, Lincoln and Mr. Apple.

Industrial and Commercial News

Commercial Intelligence.

THE WEEK IN TRADE.

The general condition of trade during the past week was a trifle quieter than during the one immediately preceding. Taken as a whole, the business for January does not seem to have come up to the expectations of either the wholesalers or the manufacturers. While it is true that there has been a steady improvement all through the month the growth has been so gradual as to amount to a disappointment in the majority of cases. Buying is still extremely conservative and there seems to be absolutely no disposition on the part of retailers to lay in complete stocks. The retail trade throughout the Western country continues to be fair, but it is not of such proportion as to form any basis of encouragement. The unseasonably mild weather during January is held responsible, in a large measure, for the quiet conditions prevailing among the retailers. The lack of money for purchasing in the South is also another drawback, and it has made collections in that section of the country unusually slow. So far there seems to be no disposition on the part of the planters to market their cotton crops. They are dissatisfied with the present prices, and so long as they are not in absolute need of money they will refrain from selling. In the West and Northwest there has been some activity in fertilizers and farm implements due, of course, to the approach of the crop making season. In that portion of the country, too, there is some disposition on the part of the farmers to hold their crops, there being a prevailing impression that grain prices will be higher in the future. In the iron and steel industries there has been practically no development. Pig iron is still very dull and few sales are made. Prices are about at the basis that has prevailed for the last two months. There are a few orders being received for structural material and the steel wire business is fairly active. In equipment lines which were expected to develop into life during January there is very little being done. The rail orders are still held up and not many purchases are being made of cars or other material. The best transaction reported during the week is the placing of an order by the Pennsylvania Railroad Company for 2200 steel cars. It is believed that other companies will be compelled to buy in the near future if there is any general resumption of business. So far the railroad earnings are still disappointing, although they show, of course, heavy increases over the comparative months of 1908 when the period of depression was at its worst. There has been some betterment in the cotton goods trade and exports in this line are becoming more liberal. The foreign trade report, however, for the month of December was disappointing. It shows a decrease in exports of $18,000,000, and an increase in imports of $19,000,000 as compared with December last year. This indicates that while there is a better buying demand from American importers, the decrease in exports is not encouraging for business generally. The balance of trade, however, is still in our favor to a large extent, and as long as this is true there will be no serious feeling of discouragement. Business failures of the week ended Jan. 28 as reported by *Bradstreet's* were 311, against 307 of the previous week, 359 in 1908, 211 in 1907, 228 in 1906 and 319 in 1905.

THE COPPER MARKET.

The downward tendency of copper became more pronounced during the past week; prices broke lower and the demand from consumers was even less positive than heretofore. There begins to be an understanding among those interested in copper that a false position has been maintained for months. This market review has insisted for many months that the quoted prices for copper were inconsistent with the statistical position as far as it was definitely known. It has been insisted that prices were being maintained by the absolute strength of the holders and in open violation of the laws of supply and demand which are presumed to control trade. The only answer to this reasoning which the producers and selling agencies could make has been to boldly assert that the statistics were untruthful. While practically admitting the accuracy of the figures showing an enormous production and while unable to disprove the figures showing a light consumption and export, they insistently declared that the subtraction of the two does not leave the heavy accumulation that seems apparent. This game of bluff has served for months to prevent any break in prices, but it is beginning to fail now. Speculators and consumers are beginning to realize that figures cannot be made to lie by simple assertion. There is a better understanding to-day of the true condition of the market than there has been for months. The exports for January have been 19,000 tons or in round numbers 38,000,000 lb. Estimating the domestic consumption at the highest, say, 60 per cent of normal, the takings for January will be but little more than 45,000,000 lb. Under such circumstances it is evident that the takings of copper both at home and abroad for the month could not be in excess of 85,000,000 lb. The domestic mine production for the month, together with the imports, will hardly be less than 110,000,000 lb. Thus we see added to an accumulation, which must already be well above 200,000,000 lb., another 25,000,000 lb. At this rate of growth there will soon be a load of copper on hand that even the great money interests back of the producing industry cannot carry. Consumers, not being particularly rushed for metal, appear to be calmly awaiting such a condition. During the past week the demand from actual consumers has been very light. Such has been the case all through January, in spite of the fact that the price of copper has been lowered 1 cent a pound in this market, and there has been an even greater reduction abroad. Standard warrants in London are weak and are really not salable at more than ½ cent below quoted prices for metal. What buying this market has developed is mostly in small lots, and as far as can be discovered there are no inquiries for round quantities. Whether there are any concessions being offered, below quoted prices, it is hard to determine. The sellers strenuously deny any such report in spite of the evident weakness of the condition. Imports for January were heavy, being in the neighborhood of 12,000 tons. The total imports for 1908 were 97,700 tons compared with 121,000 tons in 1907. Quotations on the Metal Exchange Feb. 1 were as follows:

Lake	13¾ @ 14
Electrolytic	13¼ @ 13½
Castings	13⅛ @ 13⅜

London quotations were as follows:

	Noon.	Close.
	£ s d	£ s d
Standard copper, spot	57 12 6	57 7 6
Standard copper, futures	58 12 6	58 7 6
Market	Weak.	Weak.
Sales of spot		1,700 tons
Sales of futures		1,900 tons

Extreme fluctuations for this year:

	Highest.	Lowest.
Standard	....	....
Lake	14.55	13.87½
Electrolytic	14.25	13.37½
Casting	14.12½	13.25
London, spot	£64 2 6	£57 7 6
London, futures	64 17 6	58 7 6
London, best selected	67 15 0	61 15 0

DEMANDS FOR A WIRELESS AGREEMENT.

Since the accident to the steamship *Republic*, and the part played by wireless telegraphy in the rescue of her crew and passengers, the importance of this means of communication has taken fresh hold on the public mind. Shippers and travelers alike are coming forward with demands that every steamship that carries passengers and freight not only shall be equipped with wireless outfit, but that there shall be some standardization of systems and codes and that there shall be some sort of an understanding between the various companies in the wireless business through the means of which messages will be freely interchanged. It is pointed out that if the *Florida*, the Italian emigrant ship which rammed the *Republic*, had been equipped with wireless the accident would probably have been averted, and the danger to life and the tremendous loss of property would have been avoided. That the *Florida* was not fitted with wireless was due entirely to the fact that under the present arrangements for installing the service the boat would not have paid a profit to the telegraph company. To compel the

installation of wireless on all passenger-carrying ships several movements have already been started. A bill has been introduced in Congress providing that every ocean steamer certified to carry 50 passengers or more must be equipped with wireless, and a Congressional movement, it is said, will soon be started looking toward an international agreement compelling installation of wireless and fixing a basis for interchange of service. The board of managers of the Produce Exchange has already adopted resolutions declaring "heartily in favor of such international legislation as will compel the equipment of all ocean-going passenger steamers with systems of wireless telegraphy."

Speaking of the demand for a free interchange of messages with other companies using different systems Mr. John Bottomley, vice-president and general manager of the Marconi Company, said: "There is not the slightest danger of our system being taken off of any steamship because of the question of terms, and the ship owners are beginning to see more and more clearly the necessity of having the wireless aboard. As to the movement to compel us to freely interchange messages with other companies, our position is this: We look upon all companies and systems other than the Marconi as imitators and interlopers. Why should we be expected to divide our tolls with them? We would simply be giving them added advantages and facilities for increasing their business. But this restriction on the interchange of business is only placed on ordinary commercial affairs. Every one of our operators and employees is instructed to immediately respond to any signal of distress and to any messages from United States Government ships and stations no matter what systems they come from. We do not believe we should be compelled to throw open our service to our rivals, and that is the reason we opposed the ratification of the Berlin wireless convention which practically compels us to do the very thing which we have persistently refused to do. We do not think we should be forced to recognize people that we feel have no right in the business."

Upon the same subject—a community of interest of wireless telegraph companies—Mr. W. A. Diboll, treasurer of the United Wireless Telegraph Company said: "We are strongly in favor of government regulation of the wireless telegraph business. Not government control of the companies, but regulation of the business. That is why we advocated the ratification of the Berlin treaty which was signed Nov. 3, 1906. When ships of any nation, equipped with any of the many kinds of wireless apparatus, can start from any port and keep in touch with the shore or with other ships regardless of the make of instruments that may be used, then only will wireless telegraphy be fully as useful as it should be. We think that now is the time for international action when the business is in its formative period and when the necessary standardization can be done at much less expense than later on. The United Wireless Company is by far the largest manufacturer of apparatus, controls a number of the most important patents, and is the most extensive operator of wireless telegraphy. We claim that with our present system we can guarantee service twice as far as the Marconi people and that we have done more to perfect and advance wireless apparatus than all the other concerns combined. We are doing a legitimate commercial business, are making money and our contracts with steamships are not such that we lose money on them. The Marconi company claims that it will always take a distress signal or other messages involving the safety of a ship or any of its passengers. I could name you dozens of instances where their operators have refused to accept messages of the greatest value to shipping and sometimes involving the safety of vessels. The truth of the whole matter is the Marconi company is pursuing a 'dog in the manger' policy, and will continue to do so until government control forces a change."

GAS ENGINE BUSINESS ACTIVE FOR ALLIS-CHALMERS.—The Allis-Chalmers Company reports that its gas engine shops at West Allis, Wis., are very busy at the present time, having a large number of blower contracts to be shipped out and a number of good gas engine contracts upon which to begin work. Among the more notable contracts recently made is one with the Pittsburg Plate Glass Company to furnish additional equipment for its plant at Crystal City, Mo., which already contains the famous "Big Reliable" unit of 3500-kw capacity, exhibited by Allis-Chalmers Company at the Louisiana Purchase Exposition. The new apparatus consists of two Allis-Chalmers alternating-current generators of 3000-kw combined capacity, each driven by a 34-in. x 48-in. horizontal twin-tandem Allis-Chalmers gas engine. The rotative speed is 107 r.p.m. and the total weight of each unit is about 1,000,000 lb., the flywheel alone weighing 120,000 lb. These units have been designed to carry full load at 85 per cent power factor and are guaranteed to operate in parallel, delivering 25-cycle, three-phase current at a terminal pressure of 2300 volts. Producers will furnish the gas required for the engines. For the Kokomo (Ind.) plant of the same company there are being built three Allis-Chalmers gas engines and generators of the same characteristics as the units named above, but each of half the capacity, or an aggregate of 2250 kw. For the Kansas Buff Brick & Manufacturing Company there are being built two horizontal tandem gas engines, one of 500 hp and the other of 250 hp, to operate on natural gas. They will be installed in one power plant and are to be connected, through friction clutch couplings on the outboard ends of the crankshaft, to a common transmission shaft, on which will be mounted a belt wheel carrying a belt to drive a 150-kw Allis-Chalmers generator. The 500-hp engine will also have a belt wheel from which power is to be transmitted to line shafting in the brick factory. Additional contracts for gas engines and electric generators, at present pending, involve no less than 30,000 hp.

WESTERN ELECTRIC MAKES MACHINERY RECORD FOR 1908.—Reports given out by the Western Electric Company indicate that in the machinery end of the business quite a satisfactory record was made in 1908. The sales ran far ahead of those for the previous year and there is no indication at the present time that they are falling off. The machinery shops are now operating overtime and many departments are adding additional employees. One of the largest installations recently was a 4000-kw generator for the Chicago Drainage Canal. There is no doubt that the expansion and development work among the big telephone and electrical companies has been disappointing during the month of January. The business which it was thought would materialize has not come, but there are a fair number of inquiries and there is no discouragement felt over the future prospects. Quite a considerable business has been done in supplying intercommunicating telephones for use in office buildings and large manufacturing plants. In speaking of the company's business one of the officials said: "Reports of our business for December show that it exceeded that of the same month in 1907 by about 25 per cent. The number of our customers has largely increased in the past year although the average of their purchases has been less. We do not want such a boom in business as we had in 1906, when our sales went up to nearly $70,000,000, because that necessitates too violent an expansion of our plants, but we expect a gradual expansion of our sales during the year and the total for 1909 to be far better than for 1908."

WESTINGHOUSE WAGES RESTORED.—Without making any previous announcement of the fact, the Westinghouse Electric & Manufacturing Company has increased the wages of its 3000 employees to the figures that prevailed before they were cut last March, when the policy of rigid retrenchment was enforced. This increase will amount in the total to more than $500,000 annually. This return to the old wages was brought about by Mr. George Westinghouse, personally, and was one of the first matters taken up when he resumed control of the property. The business of the company is showing steady improvement, and it is given out that the increase in January orders was $250,000 over those of December. In addition to the recent Third Avenue Railroad orders sales have recently been made to the Cincinnati Traction Company, the Washington Railway & Light Company, and the Capital Railway Company of Washington, D. C., the Oil City Railway Company and the Spokane & Inland Empire Railroad Company.

DECISION IN FAVOR OF ECONOMIC POWER & CONSTRUCTION COMPANY.—According to a decision of a New York Supreme Court, the Economic Power & Construction Company, of Buffalo, is not an electrical corporation, and therefore beyond the jurisdiction of the Public Service Commission. The company claims that its charter empowers the construction of transmission lines in any part of the State.

BARTLESVILLE (OKLA.) INDUSTRIAL BOOM.—The Bartlesville (Okla.) Commercial Club is making a vigorous campaign to attract electrical manufacturing to the town and vicinity. A tungsten lamp factory is particularly desired. The price of natural gas ranges from 2½ to 6 cents, according to quantity, and electric power is sold at the rate of 3 cents per kw-hour in quantities of 50 hp and over.

ALASKA HYDRO-ELECTRIC PLANT.—It is proposed to develop a $750,000 hydro-electric plant on the Taku run, Alaska, to supply electric power to the Treadwell group of mines in Southeastern Alaska, about 30 miles distant.

WESTINGHOUSE MACHINE COMPANY ORDERS.—That there has been a considerable improvement in the general machinery business since the beginning of the year is shown by the recent orders of the Westinghouse Machine Company, of East Pittsburgh. Quite a number of important orders for steam turbines and gas engines has been booked recently. Among these orders is one from the Mohican Oil & Gas Company, of Mohican, Ind., for a 500-hp horizontal gas engine, which is to be used for pumping gas. There has been quite a demand for power apparatus from cement manufacturing companies, which indicates a strong revival in the building trades. The Westinghouse Machine Company has received an order from the Iola Portland Cement Company, of Iola, Kan., for two 600-hp horizontal gas engines, from the Cape Girardeau Portland Cement Company, of Cape Girardeau, Mo., for a 750-hp steam turbine, and from the Standard Portland Cement Company, of Leeds, Ala., for a 1000-hp steam turbine. The company is also constructing a 600-hp low pressure steam turbine for the Potlatch Lumber Company, of Potlatch, Idaho, in which Mr. Weyershauser, the owner of lumber land, is interested. The Atlantic Mills, of Providence, R. I., one of the largest textile concerns in New England, has decided to add to its operating facilities by contracting for a 1275-hp Westinghouse steam turbine. The East Pittsburgh machine works are now working on an interesting order from the New York, New Haven & Hartford Railroad, which calls for two steam turbines of 150 hp each, the smallest of that type ever made. These turbines will be used to operate the electric signal service on the lines of that railroad. They will be installed at the Coscob (Conn.) power station. One of the largest machines of the Westinghouse steam turbine type, which is now being turned out at the East Pittsburgh shops, is a 2000-hp apparatus for the Merchants' Power Company, of Memphis, Tenn.

EUGENE MUNSELL & COMPANY OPERATING INDIAN MICA MINE.—Consul-General W. H. Michael has recently reported that an American company is operating a mica mine near Kodarma, on the East India Railway, 250 miles from Calcutta. Seven hundred hands are employed, and all of its output is sent to the United States. The firm referred to in the consular report is that of Eugene Munsell & Company, 68 Church Street, New York. This firm is one of the largest in the country and has branch offices in Chicago, Ottawa and Calcutta. It both mines and manufactures mica products and does an especially large business with the electrical companies, this branch of the industry being cared for by the Mica Insulating Company, which is closely identified with the Munsell concern. An official of this latter company said, in connection with the growth of the industry, that the constant demand from the manufacturers of electrical apparatus made the importation of large quantities necessary and was compelling the advanced American manufacturers to invest in Canadian and Indian mines in order to be assured of a constant supply. The Munsell company controls mines in both countries. Owing to this increase in demand and the fact that mica mined in the United States is unsuitable for insulation, the question of tariff is interesting all dealers. At the hearing before the ways and means committee last fall it developed that there was a wide difference of opinion as to what the proper tariff should be. Many conflicting opinions were expressed. All agreed that the present rate of 6 cents per pound and 20 per cent ad valorem on uncut mica was unjust. As this kind of mica varies from 5 cents to $3 per pound the duty varied from more than 100 per cent to about 20 per cent. This is an especial hardship on the manufacturers of mica insulation as in this industry the small sizes can be utilized by the building-up process. The use of the large sheets, it is claimed, makes the product too expensive.

SCHOTT ENGINEERING COMPANY.—The Schott Engineering Company, Chicago, Ill., has been organized to succeed W. H. Schott in the contracting and engineering business formerly conducted by him and will handle the Schott system of heating. The company is incorporated under the laws of Maine with headquarters at the American Trust Building, Chicago. The company is incorporated with $500,000 6 per cent preferred stock and $500,000 common stock to engage in every class of business known to the industrial field except the banking business. The officers of the company are: W. H. Schott, president; M. O. Payne, vice-president; C. R. Scott, secretary and treasurer. The officers, together with John D. Hibbard, A. J. Goodhue, W. A. Brown and John T. Shay, constitute the board of directors. Mr. Schott will guide the company in all of its dealings and will also carry on a general consulting engineering business. The stockholders of the new company are made up of individuals and jobbers well known to the engineering field. Among the contracts which the company has in hand at present is the construction of the government naval training station at North Chicago, which was turned over by Mr. Schott when the organization was perfected.

YORK MANUFACTURING COMPANY, YORK, PA.—There has been good business during the past few months in the line of ice-making machinery. The York Manufacturing Company, of York, Pa., reports quite a number of important sales, among which some of the larger are: 100-ton ice-making plant for Webster Citizens' Ice Company, Buffalo, N. Y.; 125-ton refrigerating machine, condensers, etc., for Alex. Manning Estate, Toronto, Can.; 150-ton ice-making plant for Beehive Hygiene Ice Company, Brooklyn, N. Y.; 20-ton refrigerating plant sold to Westerburg & Williams, New York City, for the Hudson Chocolate Company, and a 75-ton freezing and distilling system for H. Koehler & Company, New York City.

FOUNTAIN-SHAW ENGINEERING COMPANY was formed Jan. 1 with offices in the Binz Building, Houston, Tex. Mr. Fountain was until recently assistant engineer to Mr. Alex. Potter, consulting civil and sanitary engineer, in New York City; Mr. Shaw recently served as assistant engineer to the chief engineer of the Pittsburgh Railways Company, Pittsburgh, and to the Alleghany County Light Company.

NEW MICHIGAN HYRDO-ELECTRIC PLANT.—The Chippewa River Power Company has just been organized at Port Huron, Mich., for the purpose of developing the water power on Chippewa River. The plan contemplates the development of 10,000 hp which it is expected to market in the principal towns in Midland, Osceola and Saginaw Counties. The president of the new company is J. L. Hudson, of Detroit.

ELECTRICALLY EQUIPPED COAL MINES IN AUSTRALIA.—Messrs, Splatt, Wall & Company, electrical engineers of Perth, Western Australia, number among their extensive properties two electric light and power plants and a tract of coal land having an area of 10,500 acres. A mine has recently been opened on the latter with the colliery plant equipped electrically throughout.

MR. VICTOR M. ARANA, consulting and contracting engineer, Lima, Peru, writes that he will be glad to receive the trade literature of steam, hydraulic and electrical manufacturers and exporters who have not agencies in that region.

Financial Intelligence.

THE WEEK IN WALL STREET.

There is little to say of the stock market during the past week that has not been said previously during the month of January. The same apathetic condition that has existed since the beginning of the year continues to be in evidence. The trading is very light, the price fluctuations are small and there seems to be little interest in favor either of advances or decline. Even the market manipulators appear to be indifferent and to be taking a rest. For this condition of affairs very many explanations are offered by the regular purveyors of news and rumors in the Street. The admitted dullness in all lines of industry and commercial business; the agitation of the tariff adding uncertainty to the future conditions of trade; the rather unfavorable start which the winter wheat crop has made; the possible disagreement between the anthracite miners and the mine owners when the present wage schedule expires in April; the continued unsettled condition of political affairs in the Balkan States and a dozen other such reasons are assigned for the moribund condition of the market. All of these may, and probably do, to some extent affect the present condition. The basic reason, however, for the continued dullness of the market, for the light trading and fractional price changes, lies in the fact that there is no public participation in Wall Street business. When there is nothing doing except the few professional traders swapping dollars there cannot be either a great or an active market. The public must either be buying or selling, or doing both, in order to create business. This the public has failed to do for many months. Immediately after the election there were a few days in which it seemed as if the outsiders intended to come in and trade. It was for only a few days, however, and since that time any considerable order received by a

commission house from a bona fide outside customer had almost been sufficient to create a sensation in the market. Just at present the speculative element is anxiously awaiting a decision by the Public Service Commission, Second District, upon the application of the Erie Railroad to issue bonds. Not only will it fix the future condition of this railroad, but it is believed it will act as a precedent for many other bond issues which are expected to be proposed as soon as general business gives any indication of resuming normal conditions. Bond issues mean the circulation of money and the construction of improvements. These are supposed to mean business. One of the features which was discouraging to the market Feb. 1 was the adverse decision of the United States Supreme Court in the Consolidated Gas case. It was not so much the fact that a rehearing was denied, this has been anticipated, but the extreme promptness with which the court acted rather indicated that there would be allowed no trifling or delay. Gas stock broke 5 or 6 points as soon as the decision was announced, but at the lower price buying orders appeared from some quarter which caused the recovery of at least one-half the loss. One stock that always seems to be a matter of interest and an uncertain quanity is Brooklyn Rapid Transit. No one ever appears to know exactly what this road is going to do, but every one more than half suspects that it is going to do something. There are fresh crops of rumors about it every day. The fact that no action favoring a dividend was taken at the annual meeting depressed the stock and then the fact that no action adverse to a dividend had been taken again advanced it. The copper shares remain remarkably steady in the face of the declining market for copper metal and a practical acknowledgement by copper producers that the stocks in this country are larger than they have been reported to be. The money market continues to be easy and rates are unusually cheap. The banks are accumulating further cash reserves and the borrowers are not insistent, even with money at the present reasonable prices. Call loans Feb. 1 were made at 1¾ @ 2 per cent and 90-day loans were made at 2½ @ 2¾ per cent. The quotations in the table are those of the close Feb. 1.

NEW YORK.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
All.-Ch.	14½	14½	3,310	Int.-Met., pfd.	43⅞	41	20,030
All.-Ch., pfd.	46¾	46¾	5,811	Mackay Cos.	71⅞	72½	1,200
Amal. Cop.	79	73⅞	161,350	Mackay Cos., pfd.	70½	70½*	950
Am. D. T.	35*	35*	———	Manhattan Elev.	150¼*	146	391
Am. Loc.	57	56	5,600	Met. St. Ry.	34*	31*	50
Am. Loc., pfd.	112	112¼*	400	N.Y. & N.J. Tel.	115	114	330
Am. Tel & Cbl.	75½*	75½	———	Steel, com.	54	52¼	269,740
Am. T. & T.	126	125¼	3,300	Steel, pfd.	114⅛	114⅛	11,065
B. R. T.	70¼	69¾	95,715	W. U. T.	69½	68¾	700
Gen. Elec.	156	152¼	2,793	West'h., com.	82⅛	79½	3,200
Int.-Met., com.	15¾	14⅞	8,350	West'h., pfd.	115*	120*	200

PHILADELPHIA.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Am. Rys.	44½*	45	———	Phila. Elec.	12	11¾	———
Elec. Co. of A.	11	11	———	Phila. R. T.	28¾	27½	———
Elec. Stor. B'ty.	45	44	———	Phila. Traction.	92⅝	92*	———
E. S. B'ty, pfd.	49*	49*	———	Union Traction.	54⅛	54	———

CHICAGO.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Chi. City Ry.	180*	180*	———	Chi. Tel. Co.	128	128	———
Chi. Rys., Ser. 1.	116*	116*	———	Met. El., com.	17*	17*	———
Chi. Rys., Ser. 2.	45	45	———	Nat'nal Carbon.	84	84*	———
Com. Edison.	107½	108	———	Nat. Carb., pfd.	110*	110*	———
Chi. Subway.	26	26½	———				

BOSTON.

	Jan. 25.	Feb. 1.	Shares sold.		Jan. 25.	Feb. 1.	Shares sold.
Am. Tel. & Tel.	126	125½	———	Mex. Tel.	2½*	2½*	———
Cum. Tel.	125	125*	———	Mex. Tel., pfd.	5½*	5½*	———
Edison El. Ill.	251⅞	250	———	N. E. Tel.	131	130⅞	———
Gen. Elec.	156	152	———	W. Tel. & Tel.	8*	8*	———
Mass. Elec. Ry.	13	13	———	W. T. & T., pfd.	79	79*	———
Mass. E. R., pfd.	63½	62	———				

*Last price quoted.
Shares sold are for week Jan. 25 to Jan. 30.

DIVIDENDS.

Boston Elevated Railroad Company, semi-annual, 3 per cent, payable Feb. 15.

Cambridge Electric Light Company, Boston, Mass., quarterly, 2½ per cent, payable Feb. 1.

Chicago City Railway Company, quarterly, 1½ per cent, extra 3 per cent, payable Feb. 10.

Consolidated Gas Company, New York City, quarterly, 1 per cent, payable March 15.

North American Company, New York, quarterly, 1¼ per cent, payable April 1.

Susquehanna Railway, Light & Power Company, semi-annual, preferred, 2½ per cent, payable March 1.

United States Steel Corporation, quarterly, preferred, 1¾ per cent, payable March 1; common, ½ of 1 per cent, payable March 30.

Whatcom County Railway & Light Company, Bellingham, Wash., semi-annual, 3 per cent, payable March 1.

INTERNATIONAL STEAM PUMP COMPANY.—Mr. Benjamin Guggenheim, who for a number of years has been chairman of its executive committee, has been elected president of the International Steam Pump Company, succeeding Mr. John W. Dunn. Mr. Dunn resigned the presidency on account of ill-health. Mr. Guggenheim is president of the Power & Mining Machinery Company with a plant at Cudahy, Wis., which in 1906 was taken over by the International Steam Pump Company through the purchase of stock control. Speaking of the future, Mr. Guggenheim said: "The International company's plants are now running about 86 per cent of capacity. The floating debt now stands at $1,250,000 as against $4,000,000 two years ago. The most recent order of any consequence came two weeks ago from an Ohio natural gas concern—$120,000 worth of gas machinery. The directors are considering plans for raising funds for the erection of new plants in which to manufacture mining and hydraulic machinery and machinery other than steam pumps."

METROPOLITAN ELECTRIC COMPANY SELLS BONDS.—Edward B. Smith & Company have purchased the $2,000,000 first mortgage 5 per cent 30-year sinking fund bonds of the Metropolitan Electric Company, of Reading, Pa. Out of the proceeds of this sale $1,750,000 will be used to construct an entirely new power house with a modern transmission and distribution system. The demand for current in the territory which the company serves has entirely outgrown the capacity of the station which the company is now operating. The balance of the issue will be used to retire bonds which mature Oct. 1, 1909. The Metropolitan Electric Company is one of the subsidiary companies of the United Power & Transportation Company, and for 15 years has been the only company in Reading engaged in the electric light and power business. It furnishes the current used by the United Traction Company, of Reading, which company guarantees the new issue of bonds.

KOKOMO, MARION & WESTERN TRACTION COMPANY, KOKOMO, IND.—This company held its annual meeting on Jan. 25, at which time Mr. George J. Mariott, of Indianapolis, was chosen president, and Thomas C. McReynolds, of Kokomo, general manager. The report of the company shows a handsome increase in every department except the steel railway. The following is the increase in the connected load of the electric light department; Incandescent lights, 4346; commercial arcs, 37; street arcs, 28; motor capacity, horse-power, 146; new consumers, 241; heating devices, kilowatts, 73; increase in connected load, 466 kw. The increase in current consumption in 1908 for lighting purposes was about 17 per cent.

MORE TELEPHONE STOCK LISTED.—The New York & New Jersey Telephone Company has made an application to the New York Stock Exchange for the listing of $5,047,000 additional stock. It is announced in the application for this listing that the proceeds of the new stock will be used to take up outstanding obligations of $2,300,000 which were incurred in general construction work and that the balance of the money will be expended in further construction and equipment. The growth of the company's business has been steady and very satisfactory and the construction of new lines is a necessity.

CHICAGO CITY RAILWAY CONTINUES TO PROSPER.—The Chicago City Railway Company declared an extra dividend of 3 per cent last week, thus keeping up the company's record of paying 9 per cent, which has been done every year since 1901, when the rate was reduced from 12 per cent. The rate was reduced from 12 per cent when the company retired $4,619,500 4½ per cent bonds which matured July 1, 1901. About 95 per cent of the stock is still held by the Morgan-Mitchell syndicate which took control of the stock a couple of years ago at $200 per share.

SALE OF JENKINTOWN (PA.) LIGHTING PLANT.—The Gas & Electric Development Company, of Philadelphia, has just consummated a sale of the Jenkintown Light Company to a Philadelphia syndicate. The Jenkintown company supplies light and power to Jenkintown, Wyncote, Glenside, Willow Grove, Hatboro, Bethayres and other towns suburban to Philadelphia. The new board of directors include William West, Harry C. Thayer, Edward E. Mandeville, Mathew F. Maury and W. W. Levering, all of Philadelphia.

NORTH AMERICAN COMPANY RESUMES DIVIDENDS.—After passing its dividends for 18 months the North American Company of Philadelphia, a holding company for numerous traction and lighting properties, has returned to its former basis of 5 per cent. The directors at a meeting last week declared a 1¼ per cent quarterly dividend, which is payable April 1. There is outstanding $29,793,300 in common stock, and while, according to the statement of Charles W. Wetmore, the president of the company, there has not been earned an amount quite sufficient to pay the dividends, it is expected that more than enough will be earned before the end of the year. The withholding of dividends for a year and a half has placed the company in a very strong financial condition. The total amount carried forward at the beginning of 1909 to the profit and loss account was $3,445,776.

MEXICO TRAMWAYS COMPANY'S PLANS.—Having acquired a controlling interest in the Mexican Light & Power Company and having on hand large plans for future development, the Mexico Tramways Company will probably elect the following directors at the coming stockholders' meeting: F. S. Pearson, president of the Rio de Janeiro Tramway, Light & Power Company, Ltd.; Sir William C. Van Horne, chairman of the board of directors, Canadian Pacific Railway; E. R. Wood, vice-president, Central Canada Loan & Savings Company, Toronto; George Flett, managing director, Dick, Kerr & Company, Ltd., London; Julio Limantour, director, National Lines of Mexico; Robert C. Brown, managing director, Mexico Tramways Company, and Walter Gow, director, the Rio de Janiero Tramway, Light & Power Company, Ltd.

FIXING OF FRANCHISE VALUES IN BOSTON.—The State of Massachusetts has fixed for taxation purposes a value of $7,000,000 on the franchise of the Boston Elevated and a value of $9,500,000 on the franchise of the Massachusetts Electric Companies. As the cash investment in the former has been $18,144,000, and the market value of its stock is now $17,157,000, it is evident that the franchise is worth $1,000,000 less than nothing. In the case of the Electric Companies the investment has been $21,192,900, and the selling price of the stock is $18,309,065, showing that the franchise is worth $2,880,000 less than nothing. These figures are published by the two companies to show the injustice of heavy franchise valuations.

UNITED ELECTRIC SECURITIES COMPANY, BOSTON.—This company is offering through Perry, Coffin & Burr and Parkinson & Burr, of Boston, a new issue of collateral trust 5 per cent bonds due Aug. 1, 1938. These bonds are offered at par and interest. The company pays 7 per cent dividends on $1,000,000 preferred stock, and showed a surplus on Aug. 1, 1908, of $1,256,677 over all liabilities. Out of a total of $16,500,000 bonds issued by the company, it has redeemed and cancelled $11,926,000, leaving outstanding $4,574,000, including the present series.

EDISON ELECTRIC COMPANY, LOS ANGELES, CAL.—A special meeting of the stockholders of the Edison Electric Company, which is incorporated in Wyoming, but operates in California, will be held at Evanston, Wyo., Feb. 27 to vote on the proposition to increase the bonded indebtedness of the company, which is now $10,000,000, to $30,000,000. The company operates in California. R. H. Ballard, of Los Angeles, Cal., is secretary and general manager.

WESTERN NEW YORK & PENNSYLVANIA TRACTION COMPANY.—The Public Service Commission of the Second District of New York has granted permission to the Western New York & Pennsylvania Traction Company to issue additional mortgage bonds to the extent of $5,000,000. The mortgage is to be issued to the Trust Company of America and the proceeds are to be devoted to extensions and improvements.

LONDON ELECTRIC COMPANY.—The report of the London Electric Company, of Toronto, for the year ended Nov. 30, 1908, shows a net profit on operating account of $37,137, out of which were paid two semi-annual dividends of 3 per cent each. The surplus fund was increased by the addition of $15,000 and now amounts to $105,000.

KIAWATHA (KAN.) ELECTRIC LIGHT COMPANY.—The annual report of the Kiawatha (Kan.) Electric Light Company shows that the total receipts for the year ended Dec. 31, 1908, were $20,108, and the total expeditures, including improvements, $15,389. This also included a 6 per cent dividend on the $23,500 capital stock.

REPORTS OF EARNINGS.

	Gross earnings.	Expenses.	Net earnings.	Charges.	Surplus.
American District Telegraph Company:					
Year 1908	$3,192,000	$2,407,000	$785,000	$398,088	$386,912
Year 1907	3,017,174	2,304,214	712,960	396,899	316,061
Bell Telephone Company of Pennsylvania, Philadelphia:					
Year 1908	11,434,520	7,980,439	3,454,081	278,761	3,175,319
Year 1907	10,982,938	7,712,938	3,269,699	679,771	2,589,927
Birmingham (Ala.) Light & Power Company:					
Year 1908	2,167,546	1,433,850	733,696	527,386	206,310
Year 1907	2,220,999	1,521,479	699,520	479,506	220,014
Capital Traction Company, Washington, D. C.:					
Year 1908	1,841,170	793,141	1,048,029	290,947	771,886
Year 1907	1,764,345	903,481	860,864	91,500	791,527
Chicago Railways Company:					
Year ended Jan. 31, 1908	10,745,253	7,696,364	3,298,441	1,740,073	1,558,367
Year ended Jan. 31, 1907	10,367,551	7,392,400	3,168,171	1,566,158	1,602,012
Fairmount Park Transportation Company, Philadelphia:					
Year ended Oct. 31, 1908	145,543	69,681	75,862	47,541	28,321
Year ended Oct. 31, 1907	133,823	67,028	66,795	51,219	15,576
Keystone Telephone Company, Philadelphia:					
December, 1908	88,854	44,323	44,531	.....	.....
December, 1907	87,356	45,523	41,833	.....	.....
Knoxville (Tenn.) Railway & Light Company:					
Year 1908	572,271	292,784	279,487	137,952	141,535
Year 1907	605,776	332,453	282,323	129,009	153,314
Little Rock (Ark.) Light & Power Company:					
Year 1908	670,897	339,234	331,663	121,677	209,986
Year 1907	642,010	330,169	311,841	101,367	210,474
Massachusetts Electric Companies:					
Quarter ended Dec. 31, 1908	1,772,755	1,297,428	475,327	436,894	38,433
Quarter ended Dec. 31, 1907	1,780,074	1,320,663	459,411	436,436	22,975
Memphis (Tenn.) Street Railway Company:					
Year 1908	1,627,648	1,034,652	592,996	421,437	171,559
Year 1907	1,604,384	1,007,384	597,233	404,822	192,411
Mexican Light & Power Company (Mexican currency).					
Year 1908	5,876,947	2,161,140	3,715,807	.....	.....
Year 1907	4,930,370	1,950,143	2,980,227	.....	.....
New York & Queens County Railway Company:					
Year ended June 30, 1908	937,800	863,815	73,985	200,138	*119,097
Year ended June 30, 1907	913,212	782,907	130,305	162,573	*32,268
North American Company:					
Year 1908	1,723,186	274,024	1,449,162	.....	1,449,162
Year 1907	1,610,965	206,322	1,404,643	.....	287,432
Portland (Me.) Electric Company:					
Year 1908	311,514	191,078	.....	.....	.....
Year 1907	297,783	153,785	.....	.....	.....
South Side Elevated Railway, Chicago:					
Year 1908	2,241,689	1,571,065	670,624	513,342	157,281
Year 1907	2,105,192	1,459,745	645,447	615,126	30,321
Toledo (Ohio) Railway & Light Company:					
Year 1908	2,542,111	1,473,380	1,068,731	755,425	313,306
Year 1907	2,565,200	1,542,333	1,022,867	708,166	314,701

*Deficit.

GENERAL NEWS

Construction News.

DOTHAN, ALA.—The Morris Lumber Company has purchased a controlling interest in the Choctawhatchee River Light & Power Company. Work will soon commence on the construction of the dam which will develop about 4000 hp. The officers of the company are: A. C. Ackley, president; G. S. Kelly, vice-president and general manager, and A. L. Kelly, secretary and treasurer. Present post office address is Slocomb, Ala.

FAUNSDALE, ALA.—The city would like to communicate with contractors or manufacturers in regard to the construction of a proposed electric light plant and waterworks system in Faunsdale. Siddons Stollenwerck is town clerk.

MONTGOMERY, ALA.—The Montgomery Light & Power Company has offered to put up and operate free a large electric sign in some central point in the town to advertise the city, requiring only that the citizens shall agree upon some catch phrase or appropriate words to be flashed out on the sign by night.

SAMSON, ALA.—Howard Butt, 121 Sayre Street, Montgomery, Ala., has been appointed as engineer to take charge of the construction of the proposed electric light plant and water works system. W. J. Gresham, Mayor, would like to correspond with a bonding company for the purchase of $25,000 in bonds, the proceeds to be used for the construction of the above plants. Mr. Butt would like to communicate with manufacturers of machinery and equipment for the same.

PARKER, ARIZ.—It is reported that an electric light plant will be erected in Parker to furnish electricity for lamps and motors in this town, and possibly to mines in this vicinity. It is also proposed to install a 25-ton ice plant.

BATESVILLE, ARK.—H. H. Bule, of Buffalo, Ark., is said to be interested in the construction of a dam across Buffalo River, which will furnish power to generate electricity to operate an electric railway.

BENTONVILLE, ARK.—The city has awarded the Western Surety & Investment Company, of Minneapolis, Minn., a contract to construct an electric railway from Joplin, Mo., to Bentonville, and thence to Gentry, Tarrytown, Springdale and back to Bentonville. Work will begin on the construction of the railway as soon as the contract is signed. The Western Surety & Investment Company is guaranteed an appropriation of $55,000 by the citizens in this city as soon as the road is completed. A. W. Morris is mayor.

DERMOTT, ARK.—The city has taken over the local electric light plant and will operate it as a municipal enterprise. It is proposed to enlarge the plant.

LITTLE ROCK, ARK.—The City Council has under discussion the advisability of a bond issue for the purpose of building a municipal electric light and power plant.

MAGNOLIA, ARK.—The Magnolia Canning Company, it is reported, would like to receive prices on a 120-kw generator.

LOS ANGELES, CAL.—The city of Los Angeles is operating an electric plant in connection with the construction of the Los Angeles aqueduct, the equipment of which consists of four 2700-kw, 3-phase, 60-cycle, 2200-volt generators, boilers of 1250 hp, steam turbines of 1550 hp and water turbines with a total rating of 4000 hp. It is proposed ultimately to install power plants along the line of the aqueduct from Owen's Valley to the city, a distance of 240 miles. R. H. Manahan is city electrician.

PASADENA, CAL.—The City Council has rejected the offer of the Edison Electric Company, of Los Angeles, to purchase the municipal electric light plant, and is making preparations to call an election to vote on the proposition to issue $150,000 in bonds to complete the plant. The company offered to take over the real estate, buildings, machinery and transmission lines of the municipal electric lighting plant, for which it would pay the city $250,000, and also agreed to furnish electricity for street lamps at a greatly reduced rate. The company also agreed to reduce the rate for electricity for commercial purposes from 12½ cents per kw-hour to 9 cents per kw-hour, with additional reductions as low as 4 cents per kw-hour for amounts ranging from 666 kw to 15,000 kw used monthly. As an alternative proposition, the company offered to take over the municipal electric light plant and all other property appertaining thereto, with the exception of the street-lighting system, for $133,138 (the cost of the system to the city), and to furnish electricity for the municipal street-lighting system at the flat rate of 1.28 cents per kw-hour.

RED BLUFF, CAL.—It is stated that the Sierra Power Company contemplates establishing a power station in Red Bluff. R. L. Douglass is interested in the enterprise.

GREELEY, COL.—The plant and holdings of the Home Electric Light & Power Company have been acquired by the Home Gas & Electric Company, recently incorporated with a capital stock of $200,000. The new company proposes to enlarge the electric plant. It will also furnish gas for illuminating and other purposes. Robert Mc. F. Doble, Majestic Building, Denver, Col., is consulting engineer.

MERIDEN, CONN.—A new schedule of rates for electricity for lamps has been adopted by the Meriden Electric Lighting Company. Under the old schedule the company charged 12½ cents per kw-hour with a discount of 10 per cent for cash within 10 days. The new rates provide for the old discount for cash and give several additional discounts according to the quantity used.

WASHINGTON, D. C.—Plans are being considered for extensions and improvements to the street-lighting system in Washington. It is proposed to make changes in the lighting system on Pennsylvania Avenue, Seventh, F, Fifteenth, Sixteenth Streets and Massachusetts Avenue.

WASHINGTON, D. C.—Bids will be received until Feb. 9 by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., for furnishing at the various naval stations and navy yards the following supplies: Washington, D. C.—Schedule 821, furnishing and erecting two steel sectional boilers; schedule 822, one cross-compound air compressor; three model engine lathes; Boston, Mass.—Schedule 864, 1900-lb. sheet brass and 2000-lb. sheet copper. Also, until Feb. 16, as follows: Puget Sound, Wash.—Schedule 824, 2500 ft. conductor cable, 1000 ft. brass enamel conduit, 750 lb. hard sheet brass, etc. Brooklyn, N. Y.—Schedule 856, five motors, etc. Also, until March 2, at Mare Island, Cal.—Schedule 873, seven automatic motor hoists. E. B. Rogers is Paymaster-General, U. S. N.

ALBANY, GA.—The earnings of the municipal electric light plant in 1908 were the greatest in its history. The electric light department paid into the city treasury the net amount of $12,644 over and above operating expenses. In addition to this no charge was made against the city for lighting the streets, public places or public buildings.

ASHBURN, GA.—The citizens have voted to issue $55,000 in bonds, the proceeds to be used for the construction of an electric light plant, waterworks system and other improvements.

ATLANTA, GA.—It is reported that the Georgian Company would like to receive prices on new and second machinery as follows: One 100-hp engine, Ideal, Atlas, H. S. & G., or any other standard make; must have room for two pulleys; two 60 to 70 hp boilers, with Hartford tests to 100 lb.; 60 ft. heavy iron stack; duplex feed pump; water heater. Prices from second dealers must cover full description, how long in use and price net f. o. b. Will consider communication by mail only.

HAGANSVILLE, GA.—The local electric light plant, owned by M. K. Word, has been leased to Messrs. Lee, Newton and Rosser.

HAWKINSVILLE, GA.—The town has authorized an issue of $15,000 in bonds, the proceeds to be used to establish a municipal electric light plant.

LYONS, GA.—Work has begun on the construction work of a water system, upon the completion of which immediate steps will be taken toward the installation of an electric lighting plant. For further information, address S. I. Hussey.

MEIGS, GA.—Plans are being considered to install a municipal electric light plant in Meigs in the near future. It is proposed to erect a plant with sufficient output to supply 1000 lamps. D. Isreal is chairman of the light committee.

ROME, GA.—The Rome Railway & Light Company contemplates an issue of $250,000 in bonds, the proceeds to be used for extending and improving its plant.

WEISER, IDAHO.—The Idaho-Oregon Light & Power Company expects to have its transmission line completed to this city and furnish electrical service by March 1. The company offers to furnish electricity at the following rates: For residences: For 20 kw consumed in one month, 15 cents per kw-hour; for 40 kw, 10 cents per kw-hour; for 80 kw, 8 cents per kw-hour. For commercial use: For the first 50 kw consumed in one month, 10 cents per kw-hour; for 100 kw, 8 cents per kw-hour; for 200 kw, 6 cents per kw-hour; for 500 kw, 5 cents per kw-hour; for 1000 kw, 4 cents per kw-hour; for 2000 kw, 3½ cents per kw-hour; for 3000 kw, 3 cents per kw-hour, and 5000 kw consumed in one month, 2¼ cents per kw-hour.

ALEXIS, ILL.—The plant and holdings of the Alexis Electric Light Company have been purchased by John Donley, of Alexis, Ill. Mr. Donley will take possession of the property March 1. It is said that the new owner proposes to make many improvements.

BLOOMINGTON, ILL.—The Bloomington & Normal Railway & Light Company has applied to the City Council for a franchise to construct several new street car lines in Bloomington.

DANVILLE, ILL.—A special meeting of the stockholders of the Illinois Traction Company has been called for Feb. 6 to vote on the proposition to increase the capital stock of the company from $1,000,000 to $6,000,000, the proceeds to be used for extensions to the system and for the completion of the St. Louis Bridge.

LEROY, ILL.—The LeRoy Electric Light, Power & Heating Company contemplates installing a new heating and ice plant. Henry Oldham is manager.

MONMOUTH, ILL.—The stockholders of the Monmouth Telephone Company have authorized an issue of $125,000 in bonds, the proceeds to be used to improve and enlarge its system in this city.

NAPERVILLE, ILL.—It is reported that the Du Page Railroad Company is planning to construct an electric railway from Wheaton to Naperville and Plainfield during this year. Asa M. Royce, of Naperville Ill., is president.

ROCK ISLAND, ILL.—Sealed proposals will be received by M. T. Rudgren, city clerk, for furnishing electricity for 300 lamps, more or less, for lighting the streets of the city.

WATAGA, ILL.—The Village Trustees have granted a franchise to H. J. Kunkle to construct and operate an electric light plant.

WORDEN, ILL.—The City Council has abandoned the proposition to erect a municipal electric light plant in Worden, and has voted to grant a 49-year franchise to the McKinley syndicate to furnish electricity in the town. The Council will also enter into a contract with the company to furnish street-lighting service for a term of 10 years. The town had already voted to issue $12,000 in bonds for the construction of a municipal electric plant.

YORKVILLE, ILL.—The city has decided to install a new street lighting system. It is proposed to place lamps on both hills on either side of the town.

ANDERSON, IND.—The Central Union Telephone Company has decided to enlarge and improve its system in Anderson within the next few months. The cost of the work is estimated at $20,000.

LAFAYETTE, IND.—The directors of the Fort Wayne & Wabash Valley Traction Company have decided to remodel and enlarge the power plant in this city. The company proposes to sell electricity for lamps and motors, as well as to operate the interurban cars.

MEDARYVILLE, IND.—The Town Board is considering the question of establishing an electric light and power plant and will soon ask for bids for the construction and equipment of the same.

SOUTH BEND, IND.—N. M. Snyder, 518 East Bronson Street, South Bend, Ind., is reported to be in the market for 3-phase motors, variable speed and direct-current motors; also prices on complete electrical equipment and electrical supplies for a 1500-hp plant manufacturing electrical supplies.

VINCENNES, IND.—The Vincennes Light & Power Company has leased and taken possession of the local plant of the Blackhawk Gas Company. The Vincennes company will continue to buy natural gas from the Blackhawk company as long as it lasts.

CEDAR RAPIDS, IA.—The Cedar Rapids & Marion City Railway Company has presented three ordinances to the City Council asking for franchises for the construction of several new street car lines in Cedar Rapids; also for authority to make several extensions and improvements to existing lines.

COUNCIL BLUFFS, IA.—Plans are being considered by the Omaha & Council Bluffs Street Railway Company for enlarging its power house to furnish electricity, which will be required upon the completion of the number of extensions to its railway system.

DES MOINES, IA.—We are informed that the Des Moines, Winterset & Creston Electric Railway Company is making plans to commence work during the year on the construction of its proposed electric railway between Des Moines and Winterset, Macksburg and Creston, Ia. The railway will be 60 miles in length. The company expects to furnish electricity for lighting. L. H. Hixson, of Des Moines, Ia., is general manager.

UNION, IA.—The citizens have voted to grant a franchise to the Union Electric Light Company.

PARSONS, KAN.—The plant and holdings of the Parsons Electric Light & Power Company is reported to have been purchased by the Parsons Street Railway & Electrical Company for $90,000. The last named company holds a street railway franchise in Parsons and will commence work at once on the construction of a street railway system. The company also proposes to rebuild the electric light plant at a cost of about $50,000. The company is capitalized at $400,000.

TOPEKA, KAN.—Estimates are being made for the cost of equipping the Atchison, Topeka & Santa Fe Railroad, to be operated by electricity, from Trinidad to Raton, a distance of 30 miles. Electricity for operating the system will be available upon the completion of the power plant of the Southern Colorado Power Company in Trinidad. The cost of the work is estimated at not less than $2,000,000.

TURON, KAN.—We are informed that Charles McMurry, of Turon, Kan., contemplates installing an electric light plant in Turon during the coming summer and would like to communicate with manufacturers for equipment and machinery for the plant.

LONDON, KY.—The London Electric Light & Power Company contemplates purchasing a 150-hp engine during this year. W. F. Raymer is manager.

PINEVILLE, KY.—The City Council has prepared an ordinance and will soon call for bids for a 30-year franchise to construct an electric light and power plant, with an output of at least 180 kw, the equipment to include two or more generators direct-connected, both to have a rating of not less than 80 kw. B. H. Broughton is city clerk.

ALGIERS, LA.—The Algiers Railway & Lighting Company contemplates making extensive improvements and extensions to its system. It is proposed to extend the railway to the naval station, over the new viaduct and on Patterson Street, and also quite a distance in Jefferson Parish, in the near future.

BATON ROUGE, LA.—The Board of Administration of the Louisiana School for Deaf and Dumb has decided to appoint a committee to investigate the question of establishing a central power plant to supply electricity for lamps and motors to the State Capitol, Institute for Deaf and Dumb, Institute for Blind, and State University. A. S. Vreedenburg is secretary.

HOUMA, LA.—The Board of Aldermen has accepted the plans and specifications prepared by Anderson Offut, of New Orleans, La., civil engineer, for a municipal electric light plant, bids for which will be received until Feb. 9. Plans and specifications can be obtained at the office of Dreaux Angers, clerk of the board. Mr. Offut will have charge of the construction of the plant.

OPELOUSAS, LA.—Arrangements are being made by the City Council for improvements to the municipal electric light plant and water works system, which will involve an expenditure of about $35,000.

THIBODAUX, LA.—The Town Council has voted in favor of making improvements and enlarging the municipal electric light plant and an election will be held in the near future to vote on the proposition to issue $40,000 in bonds to cover the cost of the work. It is proposed to install two 75-kw alternating-current generators, Corliss engines and tub transformers for 60 arc lamps for street lighting. G. N. Borde, of New Orleans, La., has been engaged to supervise the work. A. R. Staunton is superintendent.

ANDROSCOGGIN, MAINE.—Senator Osgood, of Androscoggin, has introduced a bill to the Legislature to incorporate the Androscoggin Reservoir Company for the purpose of constructing a dam on the Magalloway River anod create a new basin in order to increase and make more constant the flow of the Androscoggin River and for use for power and manufacturing purposes. The cost of the dam is estimated at $300,000. William P. Frye, Hugh J. Chisholm, Herbert Brown and others are interested in the project.

KENNEBUNKPORT, MAINE.—It is reported that the Atlantic Shore Line Railway Company is planning to extend its railway from Sanford, Maine, through Alfred, Limerick, Kezar Falls and Fryeburg to Rumford Falls, a distance of about 120 miles.

LEWISTON, MAINE.—The committee on street lighting has awarded a contract to the Fort Wayne Electric Works, Fort Wayne, Ind., including three transformers, switchboard, generator, wires, etc., to cost between $1,700 and $1,800. The city proposes to increase the output of the municipal electric plant to furnish electricity to light the city buildings.

PEMBROKE, MAINE.—The Pennamaquan Power Company has taken over the property and holdings of the Pembroke Power Company, and proposes to rebuild the plant, which was destroyed by fire in April, 1908. The head office of the company is located in Providence, R. I. Stephen A. Welch is treasurer.

BALTIMORE, MD.—Steps have been taken by Robert J. McCuen, superintendent of lamps and lighting, looking to the final acquisition of municipal ownership of the street lighting equipment by requesting bids on all kinds of street lighting equipment.

BALTIMORE, MD.—Bids will be received until Feb. 10 by the Board of Awards for furnishing cast-iron electric lampposts and sub-posts for use under water in the swimming pool at Patterson Park in accordance with plans and specifications on file at the office of the Board of Park Commissioners. William S. Manning is general superintendent.

BOONSBORO, MD.—The Antietam Electric Light & Power Company has completed its electric plant located on the Antietam River on the site of the old Delemere Mill, about six miles south of Hagerstown, Md. The company has a contract to furnish electricity for street lamps in Boonsboro, and is contemplating entering into a contract with the town of Keedysville to light the streets of the town.

DENTON, MD.—Arrangements are being made by the Peninsular Light & Power Company to install an electric light plant and transmit electricity to Denton. About 100 hp will be developed. It is said that proposals for construction and equipment of the plant will be received about April 1. Thomas F. Garey, 16 East Lexington Street, Baltimore, Md., is president.

HAGERSTOWN, MD.—The Hagerstown Railway Company is considering the question of installing a belted 150 or 200 kw, 550-volt generator in its plant. The company will consider the purchase of a good second-hand machine.

ATTLEBORO, MASS.—The Selectmen are contemplating establishing an all-night service for street lighting for 1909. The Attleboro Steam & Electric Company, which holds the street-lighting contract, offers to furnish the additional service for about one-third more than the cost of the present schedule. The company has also agreed to replace the present 32-cp incandescent lamps with new tungsten lamps of 40 cp without extra cost to the town. The company now furnishes 333 incandescent and 104 arc lamps for lighting the streets. The all-night schedule will include continuous service in Attleboro, Hebronville, Dodgeville and South Attleboro. Edgar Tregoning is manager of the Attleboro Steam & Electric Company.

BLACKSTONE, MASS.—It is reported that the New England Securities Company, the holding company for the electric railways of the New York, New Haven & Hartford Railroad Company in Massachusetts, is contemplating the erection of a 40,000-hp electric power plant in Blackstone, at a cost of $300,000. The proposed plant will furnish electricity for operating the electric railways of the company in Massachusetts. The

plants which now furnish electrical energy for the Uxbridge & Blackstone, Milford & Uxbridge, Milford, Attleboro and Woonsocket railways will be closed.

FALL RIVER, MASS.—The Fall River Electric Light Company has applied to the City Council for permission to construct and maintain underground conduits on certain streets in the city.

HOLYOKE, MASS.—The Holyoke Water Power Company is seeking to amend its charter to enable it to furnish electricity in less than 100-hp lots to tenants of buildings erected or bought after Jan. 1, 1909.

NORTH ATTLEBORO, MASS.—Owing to the increase in demand for electricity for motors, the electric department is planning to increase the output of the municipal electric plant, and is in the market for a 150-kw, 3-phase, 60-cycle, 2300-volt generator, with exciter and switch panel. During the past year the department has carried on a campaign of advertising and soliciting for new business with tungsten lamps, heating and cooking appliances which has resulted in a large increase in the day power service. William Plattner is manager and superintendent.

QUINCY, MASS.—The stockholders of the Quincy Electric Light Company have voted to increase the capital stock of the company by $50,000.

DETROIT, MICH.—The Detroit United Railway Company has recently placed an order for the installation of an additional 1500-hp Westinghouse steam turbine, to be installed before spring.

ESCANABA, MICH.—The Escanaba Power Company is planning to extend its transmission lines to Gladstone, Mich., this year. P. L. Utley is secretary and manager.

IRONWOOD, MICH.—The Twin City General Electric Company is planning to place contracts for material for the construction of a seven-mile extension from Ironwood to Bessemer, Mich. The company is also making plans to repair its transmission lines and install new machinery in its plant, and will place a contract within the next 30 days for one 150-kw, 2300-volt, 3-phase generator; also one 200-hp, alternating-current motor connected to direct-current generator.

MANISTEE, MICH.—Plans are being prepared by the Manistee County Electric Company to develop the water power of the Manistee River, about 18 miles from Manistee. It is proposed to construct a concrete dam 90 ft. high and about 1400 ft. long. The officers of the company are: E. N. Salling, president; R. W. Smith, vice-president, and Clyde J. Holmes, secretary and treasurer.

STEPHENSDEN, MICH.—The Iron Mountain Electric Light & Power Company, of Iron Mountain, Mich., has purchased the water rights of Lower Twin Falls, on the Michigan side of the Menominee River for a consideration of $15,000. The company will commence work at once on the development of the water power, which, when completed, will supersede the present steam plant. It is proposed to develop about 500 hp. The steam plant will be held in reserve for use in emergencies.

DULUTH, MINN.—Plans are being considered by the Northwestern Telephone Exchange Company to place its wires underground in this city, which will involve an expenditure of about $100,000.

GULFPORT, MISS.—Arrangements are being made by the Gulfport & Mississippi Coast Traction Company to place contracts for the construction of 5.7 miles of track, and for the necessary overhead material.

HATTIESBURG, MISS.—Preliminary arrangements are being made by the Hattiesburg Traction Company for completion of its electric railway and construction of a new power plant, the cost of which is estimated at about $100,000. It is said that instructions have been given to place contracts for the work.

KANSAS CITY, MO.—W. Laming, of Tonganoxie, Kan., president of the Kansas City & Kansas Southwestern Railroad Company, has filed a mortgage for $12,000,000 in Kansas City, Kan., in favor of the Carnegie Trust Company, of New York, N. Y., to provide funds for the construction of electric railways between Kansas City and Topeka, and from Lawrence to Independence, Kan.

ST. LOUIS, MO.—The county court has granted a 50-year franchise to the St. Louis, Creve Cœur & Western Railway Company, of Clayton, Mo., to construct an electric railway from the city limits to Creve Cœur Lake. The railway will be built on private right of way to Studt's Park.

ST. LOUIS, MO.—The City Council has granted a franchise to the Hillsboro, Kimmswick & Northern Electric Railway Company to construct an electric railway in this city. Under the terms of the franchise the company is allowed to build its railway over streets at the extreme south end of the city on conditions that a bridge be constructed across the River des Peres.

SPRINGFIELD, MO.—Application has been made to the City Council by the Springfield Traction Company for a franchise to extend its street car line to the State Normal School.

DEER LODGE, MONT.—Plans are being considered by the Deer Lodge Electric Company for the installation of an engine, generator and arc regulator in its plant. E. A. Moe is manager.

GREAT FALLS, MONT.—The City Council has called an election to be held Feb. 15 to vote on the proposition to grant a franchise to G. C. Bower and associates to construct and operate an electric railway in and through Great Falls.

MISSOULA, MONT.—Plans are being considered for the construction of seven large dams during the next two years between Hoyt's flat and the town of St. Joe in the St. Joe River. The dams when completed will furnish power to generate electricity to operate trains through the mountain country. Plans and estimates have been completed and active work will commence as soon as the weather will permit. The total cost of the dams is estimated at from $300,000 to $400,000. The Idaho Water & Electric Power Company has been organized, with a capital stock of $500,000, to construct the plants.

ALBION, NEB.—R. T. Flotres, City Clerk, writes that it is proposed to erect a municipal heating and lighting system i nAlbion at a cost of about $6,000, for which plans have not been completed.

LORETTO, NEB.—The question of installing an electric light plant in Loretto is under consideration. E. J. Mills is reported to be interested in the project.

ELY, NEV.—The White Pine County Telephone Company contemplates extensions to its toll lines to cover the entire mining district. James S. Bennett is manager.

RENO, NEV.—Application has been filed with Frank Nicholas, State Engineer, by Rolla B. Clapp, of Reno, for an appropriation of 4000 cu. ft. per second of the Truckee River, located about one-half mile distant from Reno, opposite the Western Gypsum plant, the water power to be developed for electrical purposes and mining.

YERINGTON, NEV.—Several of the mines at Yerington have been compelled to close on account of lack of power. Owing to the washouts in Nevada, the Truckee Power Company has been unable to operate its hydro-electric plants, which necessitated the shutting off of electrical energy supplied to the mines in this vicinity. It will be a month or more before they will be able to resume.

ARTESIA, N. M.—The Board of Trustees has granted a franchise to Oscar S. Coates to erect and operate an electric light plant in Artesia.

BOONTON, N. J.—The Boonton Electric Company has leased the plant formerly operated by the Public Service Corporation of New Jersey in this town. R. M. Dickinson is general manager.

HOBOKEN, N. J.—The Hoboken Board of Trade has appointed a committee to make investigations in regard to installing an ornamental street lighting system in the business district of the city. Messrs. Geismar, Gonzales, Gerlight, Greer and King are members of the committee.

ROCKAWAY, N. J.—The High Standard Steel Company is installing an electric light plant in its factory. B. K. and G. W. Stickle, of Rockaway, and others are interested in the company.

BROOKLYN, N. Y.—Bids will be received until Feb. 10 by Bird S. Coler, president Borough of Brooklyn, for furnishing all labor and materials for repairs and alterations for lighting and power equipment in the Disciplinary Training School, Borough of Brooklyn, N. Y.

OLEAN, N. Y.—The Western New York & Pennsylvania Traction Company has been granted permission by the Public Service Commission, Second District, to issue an additional mortgage for $5,000,000 in favor of the Trust Company of America, of New York, N. Y.

ELMIRA, N. Y.—The Elmira, Corning & Waverly Traction Company has been granted a 60-year franchise by the Town Board of Ashland and the Wellsburg Valley Board for the construction of an electric railway through these towns.

FORESTVILLE, N. Y.—Application has been made to the Town Board by the Buffalo & Lake Erie Traction Company for a franchise to construct an electric railway in Forestville. The company is said to be preparing plans for building an extension of its railway between Silver Creek and Forestville.

FORT SLOCUM, N. Y.—Bids will be received by Captain Peter Murray, Quartermaster, U. S. A., until Feb. 11 for installing electric wiring and fixtures in drill hall and gymnasium building at this post. Plans and specifications and necessary information will be furnished on application to the above office.

MALONE, N. Y.—The Malone Light & Power Company has filed amendments to its charter giving it the right to make extensions to its system. The company proposes to extend its transmission line from Malone to the towns of Constable, Westville and Bangor, N. Y.

PATCHOGUE, N. Y.—The Patchogue Electric Light Company has been granted a franchise by the Brookhaven Highway Commissioners and the Town Board of Patchogue for the extension of its system throughout the entire south shore of the town, south of and including the Middle County road. The company has voted to increase its capital stock from $40,000 to $70,000, the proceeds to be used for extensive improvements to its plant. it is understood that the residents of Bellport, the Moriches, Bluepoint and other villages within the territory covered by the franchise will apply to the Town Board for permission to establish lighting districts in order to install street lamps.

PORT JERVIS, N. Y.—The plant and holdings of the Port Jervis Electric Light, Gas, Power & Railway Company were purchased by Wheeler, Curtis & Haight, attorneys for the Knickerbocker Trust Company, of New York, N. Y., at a public sale Jan. 27, to satisfy a judgment of $325,605, held as trustee by the company.

RENSSELAER, N. Y.—The Rensselaer Telephone Company, recently incorporated, is making arrangements to erect its telephone lines in this city.

ROCKVILLE CENTRE, N. Y.—The question of enlarging the municipal electric light plant is under consideration.

SYRACUSE, N. Y.—The Syracuse Rapid Transit Company is reported to be making arrangements to construct a new street car line through Greene and Robinson Streets and Shuart Avenue, for which an appropriation of $160,000 has been made.

ASHEVILLE, N. C.—The Swananoa Valley Company is making arrangements to finance its proposed electric railway, which is to extend between Biltmore and Montreat. J. M. Chiles, of Asheville, N. C., is secretary and treasurer.

BUIES CREEK, N. C.—The Buies Creek Improvement Company has been chartered to generate electricity and operate an automobile line.

GREENSBORO, N. C.—The North Carolina Public Service Company, capitalized at $3,500,000, has purchased the plant and holdings of the Greensboro Electric Company with rights of way for an interurban railway between Greensboro, High Point and Winston-Salem. Coler & Company, of New York, N. Y., are interested in the company.

LENOIR, N. C.—Eugene Ivey, superintendent of the Lenoir electric lighting plant, states that the plant will probably be enlarged in the near future.

MOUNT HOLLY, N. C.—The Woodlawn Manufacturing Company is making arrangements to install 5000 spindles in its new building, recently erected, and will require from 100 to 125 hp electrical equipment, for which, it is said, orders have not yet been placed.

SALISBURY, N. C.—The Piedmont-Carolina Railway Company has been granted a franchise by the Rowan County Commissioners to construct and operate an electric railway from Salisbury to China Grove and Landis, nine miles south of Salisbury, and to Spencer; also to the Yadkin Valley fair grounds, two miles north.

COLUMBUS, N. D.—Paul Ware, of Flaxton, N. D., has purchased the local telephone system and will make extensions and improvements thereto in the spring.

ENDERLIN, N. D.—Plans are being considered to install a gas producer engine in the local electric light plant at a cost of about $5,000.

GRAND FORKS, N. D.—The joint light committee of the City Council and Commercial Club has decided to adopt side lamps for the streets. It is proposed to erect 123 lampposts with one 10-watt and four 60-watt lamps on each post.

CANFIELD, OHIO.—An effort is being made to form a stock company for the purpose of establishing an electric light and heating plant in Canfield. W. J. Smith is interested in the project.

CINCINNATI, OHIO.—The Cincinnati, Wilmington & Xenia Traction Company, it is said, will let contracts this spring for the construction of its proposed railway. The railway will connect Cincinnati and Columbus, Ohio, and will be about 170 miles in length.

CINCINNATI, OHIO.—John J. Schoft, superintendent of the city infirmary, has requested the Board of Public Service to have plans prepared for a new electric light plant to cost $3,000, and for a new refrigerating plant to cost $15,000, for the city infirmary.

CLEVELAND, OHIO.—Plans are being prepared by the Cleveland Engineering Company for the new power plant for the new court house, to be erected at the corner of West Tenth Street and St. Clair Avenue. The cost of the building, including equipment, is estimated at from $150,000 to $200,000.

EDON, OHIO.—The Village Council is considering the question of lighting the streets of the town with electricity. It is proposed to make arrangements to have a transmission line extended from Edgertown to furnish electricical energy for the system. The cost of the street lighting service is estimated at $40 per month. Mr. Glock, of Edgerton, is interested in the Edgerton electric light plant.

LIMA, OHIO.—W. Kesley Schoepf, president of the Ohio Electric Railway Company, has submitted another proposition to the City Council offering to supply electricity for lighting the streets of the city at $57.50 per lamp per year, the new contract to begin June 11, 1909. The present contract has two years yet to run. The company also offers a reduction in prices for electricity for commercial lighting. It is understood that the Council will accept the proposition.

NEWBURG, OHIO.—Bids will be received by the Board of Public Service until Feb. 11 for lighting the streets, alleys and public places with electricity for a term of 10 years, in accordance with plans and specifications on file at the office of the City Clerk. E. T. Lawrence is City Clerk.

NEWTON FALLS, OHIO.—The Council has granted the Home Lighting Company a 20-year franchise to furnish electricity in Newton Falls.

PHILO, OHIO.—The contract for the construction of the power plant of the Center Valley Light & Power Company, to be erected on the site of the William Frazier mill at Philo, was awarded to A. W. McDonald, of Steubenville, Ohio, for $260,000.

PORTSMOUTH, OHIO.—The Board of Public Service has awarded the contract for lighting the streets of the city to the Portsmouth Street Railroad & Light Company for a period of ten years. The company is to furnish not less than 300 flaming arc lamps at $47.50 per lamp per year.

RIDGEWAY, OHIO.—The Early Light Company has taken over the plant formerly owned by J. A. Rumer, and proposes to improve and rebuild the plant. J. W. Early is manager.

YOUNGSTOWN, OHIO.—The Hydro-Electric & Gas Company has decided to construct a new building for its auxiliary power plant on Dana Avenue.

EL RENO, OKLA.—The Chichasha Power Company will make application for a franchise to furnish electricity for lamps and motors in this city. The company has recently completed a hydro-electric plant on the Washita River.

ONTARIO, ORE.—The Inter-State Light & Power Company, which is erecting a transmission line from Horseshoe Bend on the Weiser River to Weiser, has completed its line to Snake River, one mile east of the town. A substation is to be erected in Ontario.

PENDLETON, ORE.—A telephone company has been organized in Pendleton to erect a telephone line from this city to Cold Springs. J. Hanscom and Hugh Bell are interested in the project.

PANAMA.—Bids will be received at the office of the general purchasing officer, Isthmian Canal Commission, Washington, D. C., until Feb. 11 for furnishing steam pumps, electric motors, copper tubing, steel wire, etc. Blanks and general information relating to this circular (493) may be obtained at the above office or the offices of the assistant purchasing agents, 24 State Street, New York, N. Y.; Custom House, New Orleans, La., and 1086 North Point Street, San Francisco, Cal. Captain F. C. Boggs is general purchasing officer.

BEAVER FALLS, PA.—The New Castle & Beaver Falls Street Railway Company is planning to commence work on the construction of its proposed electric railway this spring. The railway will be 22 miles in length and when completed will connect Beaver Falls, Kopple, Wampum, West Pittsburg and New Castle. C. Strochecker, of Zelienople, Pa., is general manager. Main offices of the company are in the Magee Building, Pittsburg, Pa.

BLOOMING VALLEY, PA.—Plans are being made by the Central Crawford Traction Company to begin work on the construction of its proposed electric railway connecting Meadville and Titusville, a distance of about 28 miles. J. W. Heard, of Blooming Valley, Pa., is secretary and treasurer.

ELLWOOD CITY, PA.—The contract for furnishing electricity for street lamps and for public buildings has been awarded to the Pennsylvania Power Company for a term of five years for 2 1-5 cents per kw-hour.

JENKINTOWN, PA.—The Gas & Electric Development Company, of Philadelphia, Pa., has sold the plant of the Jenkintown Light Company to a Philadelphia syndicate. The Jenkintown Light Company furnishes electricity for lamps and motors to various Philadelphia suburban towns. The directors are: William West, Harry C. Thayer, Edward E. Mandeville, Mathew F. Maury and W. W. Levering, all of Philadelphia, Pa.

LINESVILLE, PA.—J. C. Dick, of Franklin, Pa., has applied to the Town Council for a franchise to install an electric light plant in Linesville.

READING, PA.—The Metropolitan Electric Company has issued $2,000,000 in bonds, the proceeds of which are to be used to take up outstanding bonds to the amount of $150,000, and the remainder for the construction of a new power house and a modern transmission and distribution system, the cost of which is estimated at about $1,500,000. The above company is a subsidiary of the United Power & Transportation Company, of Philadelphia, Pa. Bids will soon be called for construction of the plant. Walter J. Jones, 60 Wall Street, New York, N. Y., is construction engineer.

WAYNESBURG, PA.—The Green County Telephone Company has decided to make extensive improvements to its telephone lines during the coming year, at an expenditure of about $50,000.

COLUMBIA, S. C.—A bill has been introduced in the State Legislature giving the street railway companies permission to generate and distribute electricity for lamps and motors either for their own use or for sale to municipalities or the general public, as well as to operate their electric railway systems.

LEXINGTON, S. C.—A telephone company has been organized by the farmers of the Rockywell section with the following named officers: Haskell Shull, president; Marshall Hook, vice-president; W. K. Hook, secretary, and G. A. Kaminer, treasurer.

SPENCER, S. C.—Application will be made to the Legislature by the Town of East Spencer for authority to issue $25,000 water and light bonds.

PRESHO, S. D.—The Pierre-Presho Telephone Company has purchased the telephone line from Presho to Sylvia, 15 miles in length, and will extend the telephone line to Lamro, Jordan, Little Crow and Rosebud Agency at once.

MT. PLEASANT, TENN.—The question of issuing $150,000 in bonds for the construction of an electric light plant, waterworks system and for sewer system is under consideration by the City Council.

NASHVILLE, TENN.—Contracts have been awarded for the construction of an addition to the power house of the municipal electric light plant.

ARANSAS PASS, TEX.—It is reported that J. P. Gandy, of Supply, Okla., will install an independent telephone system in Aransas Pass and vicinity.

BAY CITY, TEX.—The electric light and ice plant owned by Dr. W. M. Cave, of Bay City, Tex., has been purchased by W. G. Wilcox, of Joliet, Mo.

FLORESVILLE, TEX.—T. J. and F. Largen have been awarded a contract for the construction of an electric light plant in Floresville.

SANDERSON, TEX.—E. McGinley, of El Paso, Tex., is reported to be interested in a project to establish an electric light plant in Sanderson.

TOYAH, TEX.—Plans are being made by A. G. Vanhorn, owner of the local telephone system, to entirely rebuild the town system; also overhaul the long-distance lines extending to Kent, Balmorhea, Sargosa and Pera.

ETNA MILLS, VA.—The King William Telephone & Telegraph Company is contemplating extending its telephone line from Hanover Court House to Richmond, Va.

RICHMOND, VA.—The sub-committee on electricity has appointed Pressey & Weller, of Washington, D. C., electrical and hydraulic engineers, to review the plans and specifications for the proposed municipal electric light plans prepared by Edward W. Trafford, engineer for the plant. An appropriation of $1,000 was made for the work.

CENTRALIA, WASH.—Theodore Hoss, of Centralia; A. Welch and W. J. Parterson, of Portland, Ore., who have secured a franchise to furnish electricity in Chehalis, are said to have purchased the contract for street lighting from C. L. McKenzie, president of the Chehalis Light & Power Company. The same parties hold a franchise to furnish electricity in Centralia, and also to operate a street railway system in both cities.

INDEX, WASH.—Application has been made to the City Council for a franchise by Nicholas Rudebach to construct and operate an electric light plant in Index.

KENNEWICK, WASH.—Application has been made to the City Council by the Yakima Valley Power Company for a franchise to erect transmission lines from its power plant through the Garden Tracts. It also proposes to furnish energy to the Northern Pacific Irrigation Company.

NORTH YAKIMA, WASH.—Preparations are being made by Norman Brothers, proprietors of the Hotel Tacoma and the Spokane and Yakima hotels, for the construction of a large power plant to furnish electricity for their hotels and also the entire business district of North Yakima. A central heating plant will also be installed in connection with the electric plant.

PASCO, WASH.—The American Power Company has filed water rights appropriating 500 cu. ft. of water from the Columbia River, to be used for irrigation purposes and to generate electricity for lamps and motors.

SEATTLE, WASH.—The Seattle Electric Company has been granted a franchise to extend its street railway system into the Rainier Valley along Rainier Boulevard.

SEATTLE, WASH.—We are informed that the contracts for installing the cluster lamp system on Second Avenue have been awarded as follows: For constructing underground conduit, to Charles F. McDonald, of Seattle, Wash., for $20,096; for furnishing transformers, cable, etc., to Meacham & Babcock, of Seattle, Wash., and for ornamental iron posts and cross-arms, to Olympic Foundry Company, of Seattle, Wash., for $3,954.

TACOMA, WASH.—The City Council has appointed Frank C. Kelsey, of Portland, Ore., as special engineer to have charge of the construction of the hydro-electric plant on the upper Nisqually River. The cost of the plant is estimated at $1,750,000.

PARKERSBURG, W. VA.—The Parkersburg, Marietta & Interurban Railway Company is making arrangements to construct a small power plant between Parkersburg and Marietta, on the Ohio side of the Ohio River, to supply electricity for its increasing business.

KENOSHA, WIS.—The City of Kenosha is open for propositions for furnishing electricity for street lighting. Franchises for furnishing electricity for commercial and residential lighting and also for motors will be granted. The city would also like to receive propositions for the construction of a municipal electric light plant. The population of the city is about 25,000. For further information address Peter Pirsch, chairman of the committee.

OCONOMOWOC, WIS.—We are informed that plans are being made to improve and enlarge the municipal electric light plant, the cost of which is estimated at $13,000. F. R. Hubbard is engineer in charge of the work.

WAUSAU, WIS.—The Marathon Paper Company has awarded the contract for the construction of its dam and power plant at Rothschild to O'Keefe & Orbison, of Appleton, Wis. It is proposed to develop about 8000 hp.

LANDER, WYO.—The Popo Agie Oil & Power Company is erecting a large electric power plant in the Dallas oil field, near Lander. The company proposes to generate electricity, using oil for fuel, to be transmitted to the South Pass mines. It will also furnish electrical energy to Lander and other towns in Fremont County for lamps and motors.

LARAMIE, WYO.—Hartley C. Taylor, of Kansas City, has been granted a franchise by the City Council to operate an electric light system in Laramie. He proposes to construct a hydro-electric plant to be located not more than 60 miles from the city.

CALGARY, ALB., CAN.—Bids will be received by the City Commissioners of the city of Calgary until Feb. 18 for furnishing the city with three water-tube boilers with a rating of 1000 hp, with piping and induced draft system for 2500 hp; also one 500-kw generator connected to a 750-hp high-speed engine for railway system, with condenser, switchboard, etc. Plans and specifications can be had on application to the city engineer. H. E. Gillis is city clerk.

CALGARY, ALB., CAN.—Bids will be received by the Commissioners of the city of Calgary, Alb., until Feb. 18 for street railway material, including track material, street railway cars, sprinkler, sweeper and overhead construction. Equipment for overhead construction will consist of steel span wire pole, 30 ft. and 35 ft., three sections; cedar poles; 12.5 miles of 00 trolley wire; 10.2 miles of 000 feed wire; span wire; hangers, insulators and conical strain insulators, ears, cross-overs and trolley frogs. Bids will be received upon the entire schedule or any item of the same. Full particulars and specifications will be supplied at the city engineer's office. H. E. Gillis is city clerk.

FERNIE, B. C., CAN.—Negotiations are pending with the Crow's Nest Pass Electric Light & Power Company for the installation of an electric lighting system here to replace the one destroyed last August.

MONCTON, N. B., CAN.—The City of Moncton has applied to Parliament for permission to construct and operate a municipal electric street railway. John S. McGee is city clerk.

COBOURG, ONT., CAN.—Application has been made to the Ontario Legislature, by G. H. A. Ward, for a charter for the Cobourg, Port Hope & Havelock Railway Company, which proposes to construct an electric railway to connect Port Hope and Cobourg, extending across the country to Warkworth, Campbellford and Havelock, thus connecting the lake front towns with the Canadian Pacific Railroad. A branch will also be constructed from Cobourg to Gore's Landing.

LINDSAY, ONT., CAN.—A motion has been made in the City Council to buy out the holdings of the Lindsay Electric Heat, Power & Light Company.

LINDSAY, ONT., CAN.—The City Council has appointed a committee to make investigation in regard to municipal ownership of lighting plant, with a view to purchasing the plant of the Electric Heat, Light & Power Company on the expiration of its franchise in about two years.

ST. LAMBERT, QUE., CAN.—The ratepayers voted in favor of granting a franchise to the Montreal & Southern Counties Electric Railroad Companies to operate an electric street car system here.

REGINA, SASK., CAN.—The city has protested to the Saskatchewan Legislature regarding the proposed charter to the Regina Interurban Electric Railway. The result is the company will be allowed to build only one line from the city. It is the intention of the city to construct a municipal street railway.

GUADALAJARA, MEX.—It is reported that Manuel Cuesta, of Guadalajara, who owns valuable water power rights on the Santiago River, including a concession for the installation of a large hydro-electric plant, will soon begin work on constructing of a plant. It is proposed to transmit electricity from the plant to Lake Chapala, where it will be utilized to operate electric pumps for irrigating large tracts of land.

GUANAJUATO, MEX.—The Guanajuato Light & Power Company has decided to erect another hydro-electric plant at El Duro, which will have an output of 9,000 hp. The plant, when completed, will give the company a total output of 20,000 hp. The company has recently completed a new double transmission line to points in the Guanajuato territory. Norman Rowe is general manager.

MEXICO CITY, MEX.—The Mexican Light & Power Company has let the contracts for the construction of three tunnels and canals for the purpose of diverting the water from outside of the watershed to the reservoirs of the company at Necaxa in order to add to the present water supply for the power plant at that point. One of the tunnels will be about 4500 ft. long and each of the other two about 1200 ft. long. The canal will be about two miles long.

PATZCUARO, MEX.—Francisco Contreras and Romualdo Fagoaga are planning to utilize the water of Lake Patzcuaro, in the State of Michoacan, and are preparing to install a hydro-electric plant and build transmission lines.

PUERTO, MEX.—Concessions have been granted by the State of Vera Cruz to Manuel L. De Guerara, of Puerto, Mex., for the construction of a tramway in this city.

SANTA ROSALIA, MEX.—The Compania Agricola y de Fuerza Electrica del Rio Conchos has been organized, with a caiptal stock of $10,000,000, to construct a large hydro-electric plant and transmission system in the State of Chihuahua, Mex. It is planned to construct a large dam across the Conchos River near the town of Santa Rosalia, State of Chihuahua. Transmission lines will be erected to the cities of Chihuahua and Parral and to various mining camps, and to industrial centers within a radius of 175 miles. The plans of the company also call for the irrigating of about 100,000 acres of land which will be reclaimed from the valley of the Conchos River. The pumps will be operated by electricity. Paul Ginther is president.

URUAPAN, MEX.—A syndicate of Americans and Mexicans is preparing to install a large hydro-electric plant at the waterfalls of Cupatitzio, State of Michoacan. The concession for the enterprise has been obtained by F. Rodriguez on behalf of the syndicate. It is planned to erect transmission lines from the hydro-electric plant to the Town of Uruapan and other industrial and mining localities in that region to supply electricity for lamps and motors.

Company Elections.

UTICA, N. Y.—At the annual meeting of the Ballda Electric Company the following named officers were elected: H. S. Ballda, president; F. E. Ballda, vice-president; A. W. Ballda, secretary, and W. C. Ballda, treasurer.

GALVESTON, TEX.—At the annual meeting of the Brush Electric Light & Power Company the following directors were elected for the ensuing year: John Sealy, Sealy Hutchings, John C. Walker, R. Waverly Smith and Henry Runge.

ATLANTA, GA.—At the annual election of the Georgia Railway & Electric Company the following officers were elected: P. S. Arkwright, president; C. E. Brine, vice-president, treasurer and general manager, and W. H. Glenn, secretary and manager of railways.

FITCHBURG, MASS.—At a meeting of the stockholders of the Fitchburg Gas & Electric Company, held Jan. 27, the following officers were elected: Charles H. Tenney, president; A. B. Tenney, general manager; Clifton R. Hayes, resident manager; William L. Walker, superintendent; Palmer York, treasurer. The board of directors is now composed of Herbert I. Wallace and Charles E. Ware, of Fitchburg, member of the former board; C. H. Tenney, F. P. Royce, H. P. Wood, Philip Cabot and A. B. Tenney, of Boston.

SIKESTOWN, MO.—At the annual meeting of the Sikestown Ice, Light & Power Company the following named officers were elected: C. D. Mathews, president; S. B. Hunter, vice-president; E. C. Matthews, secretary and treasurer, and C. L. Clary, general manager.

DOYLESTOWN, PA.—At the annual election of the Doylestown Electric Company the following named directors were elected: William H. Kirk, Harvey L. Scheetz, Samuel A. Hellyer, Frank L. Worthington, George W. McIntosh, John P. Stillwell, E. Wesley Keeler, Nelson K. Leatherman and George C. Hill.

POTTSTOWN, PA.—At the annual meeting of the Pottstown Light, Heat & Power Company the following named directors were elected: J. Allen Healy, Edgar S. Cook, Jacob C. Sotter, George N. Malsberger, John W. Healy, John W. Storb, J. Harry Carey. The directors elected J. Allen Healy president and Samuel H. Fridy, secretary and treasurer.

New Industrial Companies.

THE STANDARD IGNITION COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $2,500, to manufacture electrical devices by F. J. Casey, George L. Fish and A. A. McClanahan.

THE CUTTER LIGHT & STOVE COMPANY, of Chicago, Ill., has been incorporated, with a capital stock of $15,000, to manufacture lighting and heating devices, by George M. Cutter, Charles J. Puffer and William W. Kirtland.

THE ACME RAILWAY & STATIONARY REFRIGERATING COMPANY, of Camden, N. J., has filed articles of incorporation, with a capital stock of $125,000, for the purpose of manufacturing refrigerating machinery, electric motors, etc.

THE CONSTANT SUPPLY COMPANY, of Chicago, Ill., has been chartered, with a capital stock of $100,000, for the purpose of manufacturing machinery and mechanical devices. The incorporators are Clarence D. Fuller, Ada L. Ames and Robert P. Bates.

THE CAMPBELL BELTING COMPANY, of Jersey City, N. J., has filed articles of incorporation, with a capital stock of $50,000, to manufacture machine belting. The incorporators are A. L. Campbell, J. Newberger and J. Nagengust, all of Jersey City, N. J.

BENNETT & BROWN, of Paterson, N. J., has been incorporated, with a capital stock of $10,000, by Arthur T. Bennett, of Suffern, N. Y.; Hector H. Brown and Edward R. Weiss, both of Paterson, N. J. The company proposes to do electrical construction work.

THE TRIPLE AIR LIGHT COMPANY, of New York, N. Y., has been incorporated, with a capital stock of $50,000, by C. A. Campbell, A. W. Lurcott, of Brooklyn, N. Y., and M. May, of New York, N. Y. The company proposes to do a general electrical business.

THE CHARLOTTE MACHINE COMPANY, of Charlotte, N. C., has been granted a charter to manufacture and deal in electrical appliances, mill supplies and engines, with a capital stock of $2,000. The incorporators are F. J. Osborne, Thomas Costello and Albert M. Guillet.

THE ADRIA ARC LAMP COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $1,000, for the purpose of manufacturing gas and electric lamps. The incorporators are Leopold Wolf, Leo Altman and Bessie Altman, all of New York, N. Y.

THE MOTOR APPLIANCE COMPANY, of Perth Amboy, N. J., has been chartered, with a capital stock of $25,000, by Joseph P. Hall, Albert S. Deveau and Clarence C. Sibley. The company proposes to manufacture machinery, mechanical devices and engineering appliances, etc.

THE MORGAN ELECTROPLATING & MANUFACTURING COMPANY has filed articles of incorporation with the Secretary of State at Wilmington, Del., with a capital stock of $25,000. The incorporators are J. R. Morgan, H. O. Spangler, A. W. Kelly, all of Pittsburg, Pa.

THE AMERICAN WATER SUPPLY COMPANY, of Newark, N. J., has been chartered, with a capital stock of $400,000, to deal in machinery, tools, mechanical devices, etc., by Lawrence W. Luellen, Hugo Moore, of New York, N. Y., and Austin M. Pinkham, of Boston, Mass.

THE N. FROOKS COMPANY, of New York, N. Y., has filed articles of incorporation, with a capital stock of $4,000. The incorporators are N. Frooks, Louis Singer and Adam Mark, all of New York, N. Y. The company proposes to deal in hot-air devices, engines and pumping machinery.

THE C. J. LITSCHER ELECTRIC COMPANY, of Grand Rapids, Mich., has been chartered, with a capital stock of $20,000, to deal in electrical machinery and appliances. The officers of the company are: C. J. Litscher, president; S. C. MacNeil, vice-president, and J. M. Loudon, secretary and treasurer.

THE H. C. GREENLAW COMPANY, of Boston, Mass., has been incorporated, with a capital stock of $10,000, to manufacture plumbing, gas and electrical fittings. The officers of the company are: William C. Adams, of Dorchester, Mass., president; Harry C. Greenlaw, of Quincy, Mass., treasurer and clerk.

THE STERLING ENGINEERING COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $100,000, by Roland D. Crocker, Harry H. Poole, of Newark, N. J., and William H. Daly, of Bloomfield, N. J. The company proposes to construct railways, bridges, water courses and aqueducts.

FITZPATRICK & COOMBS, of New York, N. Y., has been chartered by Jesse Arnette Fitzpatrick, Robert D. Coombs, Arthur W. Coombs, all of New York, N. Y., and John T. Fitzpatrick, of Albany, N. Y. The company is capitalized at $1,000 and proposes to carry on a business of building engineers and contractors.

THE R. W. MARSHALL COMPANY, of New York, N. Y., has been chartered by Charles C. Mann, Flatbush, N. Y.; Frank L. Quinby and Eugene C. Bogwell, of New York, N. Y. The company is capitalized at $150,000 and proposes to manufacture and deal in electrical and mechanical appliances and apparatus, etc.

THE INTERBOROUGH AUTO REPAIR & SUPPLY COMPANY, of Cold Spring, N. Y., has filed articles of incorporation, with a capital stock of $15,000. The incorporators are Frederick A. Verdon, Daniel McElroy and John McRoberts, all of Cold Spring, N. Y. The company proposes to build automobiles and electric cars.

THE INSTANTANEOUS ELECTRIC WATER HEATER MANUFACTURING COMPANY, of Newark, N. J., has been incorporated, with a capital stock of $25,000, by Joseph A. Shepperd, Thomas P. McCrane, of Newark, N. J., and James G. Alden, of Providence, N. J. The company proposes to manufacture an electric water heater.

THE ECONOMY FRICTION DRIVE & PULLEY COMPANY, of Boston, Mass., has been chartered, with a capital stock of $100,000, to deal in pulleys and machinery. The officers are: William H. Lafacile, president; John A. McDonald, vice-president; Amos M. McLean, treasurer, and Daniel E. Irwin, clerk, all of Boston, Mass.

THE INTERSTATE ENGINEERING & SUPPLY COMPANY, of Hoboken, N. J., has been chartered, with a capital stock of $100,000, as builders and contractors for construction of railroads, water, gas and electric works, tunnels, bridges, viaducts, etc. The incorporators are William F. Eidell, John A. MacPeak, of Hoboken, N. J.

New Incorporations.

JACKSONVILLE, ALA.—The Calhoun Light & Power Company has been incorporated with a capital stock of $5,000 by O. H. Herring, H. R. Rice and John P. Park.

OAKLAND, CAL.—The Oakland & Antioch Railway Company has been chartered, with a capital stock of $2,000,000, to construct an electric railway from Oakland to Bay Point, a distance of about 30 miles. The directors are: A. W. Maltby, of Concord, Cal.; S. L. Naphthaly, Allan Pollok, Walter Arnstein and F. W. Smith, all of San Francisco, Cal.; F. S. Brooks, of Alameda, Cal., and H. A. M. Mitchell, of Berkeley, Cal.

GREELEY, COL.—The Grover & Sligo Telephone Company has been incorporated with a capital stock of $10,000 to erect about 35 miles of telephone lines east and west to connect with the lines of the Colorado Telephone Company.

WILMINGTON, DEL.—The Montana Rapid Transit Company has been incorporated, with a capital stock of $5,000,000, to construct and operate electric railways.

ABBEVILLE, GA.—A charter has been granted by the Secretary of State to the Abbeville & Northwestern Railroad Company, with a capital stock of $100,000, to construct a railway connecting Abbeville with Fort Valley. The main line will be 58 miles in length, with a branch to Montezuma 17 miles long.

RUPERT, IDAHO.—The Settlers' Mutual Telephone Company has filed articles of incorporation with a capital stock of $48,000. The incorporators are L. R. Adams, R. W. Adams and Charles C. Nelson.

AUGUSTA, ILL.—The Augusta La Prairie Telephone Company has been incorporated with a capital stock of $1,000 by J. E. Pettijohn, Henry Ippensen and S. L. Miller.

AVON, ILL.—The Banner Telephone Company has been organized by B. W. and A. E. Rubart. The company proposes to construct a telephone line from Avon through the country into St. Augustine.

CHESTER, ILL.—The Chester Water & Power Company has been incorporated, with a capital stock of $7,000, by Edward P. Bronson, C. G. Randall and Don E. Detrick.

DORCHESTER, ILL.—Articles of incorporation have been filed for the Dorchester Telephone Company, with a capital stock of $1,875, by D. M. Thompson, Henry H. Bauer and F. B. Luken.

MARISSA, ILL.—The Star Telephone Company has been chartered, with a capital stock of $100, by G. F. Paul, R. J. Mearns and W. R. Lyon.

VERMILLION GROVE, ILL.—The Vermillion Grove Telephone Company ha sbeen incorporated with a capital stock of $5,000 by John M. Kendall, C. M. Hester and D. J. Pugh.

FOUNTAINTOWN, IND.—The Readywine Telephone Company has

been chartered with a capital stock of $600 by Richard W. Low, J. E. Gunn, William E. Reese, Jesse E. McRoberts and James P. Scott.

INDIANAPOLIS, IND.—Articles of incorporation have been filed for the People's Co-operative Telephone Company, of Boone and Hendricks counties, with a capital stock of $5,000.

JAMESTOWN, IND.—Articles of incorporation have been filed for the People's Co-operative Telephone Company, with a capital stock of $5,000 by George W. Pierson and others.

SEYMOUR, IND.—The Jennings & Jackson Telephone Company has been formed to construct a telephone line from Seymour to County Line. The officers are: L. Richart, president; William Kessler, vice-president; Fred Nichaus, secretary, and P. Speckner, treasurer.

GUTTENBURG, IA.—The West Union Rural Telephone Company has been organized by J. Shay, of McGregor; T. Morrison, of Decorah, and C. Curtz, of McGregor.

WILTON JUNCTION, IA.—The Moscow-Wilton Rural Telephone Company has been chartered with a capital stock of $500. H. H. Will of Moscow, will be secretary.

LYNNVILLE, KY.—The Lynnville Telephone Company has filed articles of incorporation with a capital stock of $4,000. The incorporators are: R. B. Pryor, Henry Conner and C. M. Richardson.

LOUISVILLE, KY.—Articles of incorporation have been filed for the Mutual Telephone Company, of Grayson County. The company is capitalized at $600, and the incorporators are: A. Moore, C. D. Moore and R. M. Cannon.

PILOT OAK (P. O. FULTON), KY.—Articles of incorporation have been filed for the Pilot Oak Telephone Company with a capital stock of $1,500 by J. A. Shelby, I. T. Howard and M. H. Weems.

SCIENCE HILL, KY.—The Science Hill Telephone & Exchange Company has been incorporated with a capital stock of $800 by William Lowery, T. W. Denney, A. Y. Hayes and others.

SEDALIA, KY.—The Sedalia Telephone Company has been incorporated, with a capital stock of $5,000, by A. K. Jones, R. F. Jones and G. G. Jones.

FRIENDSVILLE, MD.—The Youghiogheny Power Company has been incorporated with a capital stock of $100,000 to develop the water power of Youghiogheny River and its tributaries in Garrett County for the generation of electricity. The directors are: Clifford L. Pullin, Heber Crane, of New York, N. Y.; Carleton M. Moody, of Philadelphia, Pa., and William A. Morgart, of Cumberland, Md.

BROWERVILLE, MINN.—The Ward & Moran Telephone Company has been organized to erect and operate a rural telephone line to Long Prairie. E. T. Crist is president and Frank Haverick, secretary.

REDWOOD FALLS, MINN.—The Redwood Falls Electric Telephone Company has been incorporated with a capital stock of $50,000 by F. W. Philbrick and others.

KANSAS CITY, MO.—Articles of incorporation have been filed for the Missouri & Cameron Railway Company by William W. Lewis, Charles O. French, William A. Medill, Fred M. Titus and N. S. F. Peabody, all of Kansas City, Mo. The company is capitalized at $350,000, and proposes to construct a railway from the Missouri River in Platte County to Lathrop, a distance of 35 miles.

WEST PLAINS, MO.—The Globe Telephone Company has been organized to construct a rural telephone line to connect with the local exchange. John G. W. Richardson is president and Asa Jarrett secretary.

CAMDEN, N. J.—The American Gas & Power Company has been incorporated, with a capital stock of $1,000,000, by W. S. Darnell, M. H. Darnell and G. D. Connelly, all of Camden, N. J. The company proposes to manufacture and generate light, heat and power.

ELIZABETH, N. J.—The Traction Development Company has been chartered, with a capital stock of $100,000, for the purpose of securing franchises, rights of way and engineering plans for the Elizabeth & Amboy Traction Company, which proposes to operate an electric railway between Elizabeth and Perth Amboy. The incorporators are: Richard F. Pettigrew, Richard M. Montgomery, Dr. H. B. Hoagland, W. J. Lansley, C. A. Trimble and P. A. Peterson. Percival E. Jones, 27 Pine Street, New York, N. Y., is general counsel.

MIZPAH, N. C.—The Quaker Gapp Telephone Company has been incorporated, with a capital stock of $3,000, by W. G. Slate, J. W. Slate and W. C. Slate.

MEDINA, N. D.—The Central Telephone Company has been incorporated, with a capital stock of $100,000, by William J. Dwyer, Mary C. Dwyer and Katherine Dwyer, all of Medina, N. D.

MARYSVILLE, OHIO.—The Union County Farmers' Telephone Company has been organized at York, Ohio, with a capital stock of $24,000. The following officers have been elected: J. D. Coe, president; Charles Vanhining, vice-president; William Plotner, secretary and J. O. Thomas, treasurer. Post office address, R. F. D., Peoria, Ohio.

POLK, OHIO.—The Polk Rural Telephone Company has been incorporated with a capital stock of $8,000 to operate a telephone system in Wayne and Ashland counties. The incorporators are: John F. Smith, John S. Kauffman, Harriette Riggs, H. Smith and Alice E. Smith.

YOUNGSTOWN, OHIO.—Articles of incorporation have been filed for the Block Light Company with a capital stock of $50,000 by Otto Kaufman and others.

COUNCIL HILL, OKLA.—The Council Hill Telephone Company has been chartered, with a capital stock of $10,000, by Trevor Faulkner, Otto E. Sump and others.

DUNCAN, OKLA.—The Washita Valley Rural Telephone Company, of Fair, Okla., has been chartered with a capital stock of $5,000 by W. G. Brymer, J. M. Brymer, of Fair; D. Brymer, of Duncan, Okla., and M. E. Harris, of McKinney, Tex.

ELGIN, OKLA.—The Elgin Farmers' Telephone Company has been incorporated with a capital stock of $3,000 by E. A. Roll, I. A. Fisher and H. E. Cline, all of Elgin, Okla.

GEARY, OKLA.—Articles of incorporation have been filed for the Atlanta County Telephone Company with a capital stock of $1,000. The directors are: A. B. Campbell, Otto Pallas and T. P. Quayle, all of Geary, Okla.

KEYSTONE, OKLA.—Articles of incorporation have been filed for the Keystone Telephone Company, with a capital stock of $400, by S. N. Alburty, C. O. Reynolds, A. J. Snow and P. E. Long.

SUMPTER, OKLA.—The Sumpter Telephone Company has been chartered, with a capital stock of $1,000, by Frank Wells, A. W. Newcomb, C. E. Geiger, William Riles and B. Esterday, all of Braman, Okla.

BURNS, ORE.—The Eastern Oregon Telephone & Telegraph Company has filed articles of incorporation with a capital stock of $10,000. The incorporators are: J. R. Jenkins, J. H. Jordan and E. T. Jenkins. The company proposes to construct a telephone line from Burns to Lawen to connect the Halley Valley line with the line from Burns to Paulina, and also plans to make connections with the vale as soon as possible.

HUNTINGDON, PA.—The Standing Stone Telephone Company has filed articles of incorporation with a capital stock of $5,000.

LEWISTON, PA.—The Juniata Valley Telephone Company has been incorporated with a capital stock of $5,000.

PLEASANT MOUNT, PA.—The Pleasant Mount Water & Light Company has been organized with the following named officers: J. D. Brennkerry, president; J. E. Tiffany, secretary, and J. W. Bunnell, treasurer.

TOWER CITY, PA.—The Porter City Township Light, Heat & Power Company has been chartered with a capital stock of $5,000.

HAYTI (P. O. HAMLIN), S. D.—The Hamlin County Farmers' Telephone Company has been incorporated with a capital stock of $25,000 by Warren Greene, A. H. Anderson, K. G. Knudtson, Edward Arzberger and P. O. Svarari.

VOLIN, S. D.—Articles of incorporation have been filed for the Volin Telephone Company with a capital stock of $25,000 by Iver Bagstad, A. O. Bagstad, Ole Peteson, Edward O. Leir and James F. Volin.

SPRING CREEK, TENN.—The Log Cabin Telephone Company has been formed to operate a telephone line from Spring Creek to Medina and proposes to extend the line through to Jackson. H. P. Utley is secretary and treasurer and G. W. Fly manager.

GILMER, TEX.—The Gilmer Ice, Light & Power Company has been incorporated with a capital stock of $40,000 by T. E. Harnwell, Lewis Monroe and J. E. Barwell, all of Gilmer, Tex.

NACHEZ, WASH.—The Nachez Irrigation & Power Company has been incorporated, with a capital stock of $8,000, by W. S. McPhee and others.

SPOKANE, WASH.—Articles of incorporation have been filed for the Spokane-Idaho Irrigation & Power Company, with a capital stock of $5,000, by O. R. Haight and others.

MANNINGTON, W. VA.—Articles of incorporation have been filed for the Consumers' Electric Light Company, with a capital stock of $100,000, by C. E. Morris, H. A. Nolk, Herman A. Hundt and others.

EAU CLAIRE, WIS.—The Chippewa Flambeau Improvement Company has been formed and will soon apply to the Legislature for a charter. The company proposes to erect a reservoir system to develop water power. Daniel Buchanan and William Irvine, of Chippewa Falls, Wis.; E. R. Sherry, of Park Falls, and W. L. Davis, of Eau Claire, are interested in the project.

SUNDANCE, WYO.—The Inyan Kara Telephone Company has been formed to extend the independent telephone line, which now terminates at Perrigoue, to Newcastle.

AYR, ONT., CAN.—The Ayr Rural Telephone Company has been incorporated with a capital stock of $10,000.

Legal.

WESTERN UNION'S FRANCHISE IN GEORGIA.—An important decision has been handed down by Judge Newman in Federal Court, at Atlanta, Ga., holding that the contention set up by the Western Union Telegraph Company that its franchise was given under Federal statutes, and is therefore not subject to tax levies made by a State, is not valid and is denied by the court. The matter will go to the Supreme Court.

TELEPHONE SWITCHBOARD LITIGATION.—Judge Kohlsaat, of the United States Circuit Court of the District of Chicago, has rendered a decision in favor of the Sterling Electric Company in a suit against the Western Electric Company involving a multiple switchboard invention claimed by the latter company as that of F. R. McBerty and by the former company as the invention of Samuel B. Fowler. Judge Kohlsaat's decision holds that Fowler's contentions as to priority are sustained beyond reasonable doubt.

ELECTRIC COMPANY NOT LIABLE FOR INJURY TO LINEMAN BECAUSE OF BREAKING OF CROSS-ARM.—It is the duty, as a matter of law, of a lineman, engaged in adjusting wires many feet above the ground, to inspect the cross-arm to which they are attached before placing his weight upon it and ascertain if it is strong enough to hold him; and where it does not appear that the lineman took the precaution of inspecting the cross-arm before climbing upon it, he is not entitled in an action against the company for damages to have the jury determine whether or not he failed in his duty. Camille B. Johnston v. Syracuse Lighting Company, N. Y. Court of Appeals, N. Y. Law Journal, Dec. 31, 1908.

FIRE CAUSED BY NEGLIGENCE IN MAINTENANCE OF TELEPHONE WIRES.—A recent decision of the Supreme Court of Appeals of Virginia holds a telephone company responsible in damages for a fire resulting from the improper manner in which the company's wires were maintained. The facts appear in the following statement by the court: "There is no question that there was a fire in the plaintiff's storehouse, and that the damages resulting to him therefrom were equal to the amount found by the jury. There was evidence that the fire started in the corner of the building where the telephone was located; that about two hours before the storehouse was discovered to be burning a fire did occur in the cable box on a telephone pole near Gibson's corner, from which point the wires ran into the plaintiff's storehouse; that the defendant's wires not far from that corner crossed under the heavily charged wires of the city's electric light system, and so near to them (1 in.) that they might come in contact with them, and had on several occasions given trouble because of such contact; that the city wires were as high as they could be placed on the poles, and that it had notified the telephone company that the latter's wires had been placed too near the electric light wires, and requested it to lower them, as could have been done, but no attention was paid to the request, though several times made; that the defendant had failed, when the telephone was installed in the storehouse, to put in a fuse block, an appliance in common use, which was intended to and did prevent the flow of electricity when unduly heavy, and the consequent damages resulting therefrom; that on the night of the fire there was trouble with the telephone, of which the defendant had notice. The conduct and admissions of the president and general manager of the defendant at and about the time of the fire tended to show that they believed that the telephone was the cause of the fire, as did the statement of the electrician of the Southeastern Tariff Association, who represented 50 or more insurance companies, and was sent to the scene of the fire to examine into its origin. There is no evidence in the cause which shows that it was reasonably probable that the fire originated in any other manner." Stauntoj Mutual Telephone Company v. Buchanan, 62 S. E. Rep. 928.

TELEPHONE AS A MEDIUM FOR PRESENTING PROMISSORY NOTE FOR PAYMENT.—That the law keeps pace with modern inventiveness is evidenced in a recent decision of the Supreme Court of New York to the effect that a promissory note may be presented to the maker for payment in a conversation had with him over the telephone. The note in the case was payable at 507 Prospect Place, Buffalo, N. Y. On the day on which the note matured a clerk in the employ of the bank which held the note called up the maker on the telephone at his residence, which was the place of payment, and asked if the note would be paid. The maker, after being informed that the note would not be renewed, stated that he was unable to pay it. In an action at law on the note, which the bank brought against the party who had endorsed it, the defense was that the endorser had been released by reason of the fact that the note had not been presented for payment at 507 Prospect Place in accordance with its terms. In answer to the question as to whether the note had been presented to the maker at the place of payment, said the court: "We think it was. At the time of the conversation between the maker and the bank official over the telephone the maker was actually at the place of payment. The talk was immediately between him and the holder of the note. For every purpose of demand and refusal it was just as effective as though the conversation had taken place between the parties when all were within the walls of the house itself. The use of the modern invention of the telephone is recognized by the courts. Commercial transactions and conversations had over the telephone have been recognized as of the same binding force as where the parties talked face to face. The telephone is simply an instrument by which two persons may talk directly to each other. Suppose the holder of a note should call to the maker from across the street, as the maker stood in his doorway, and notify him that he had his note and ask payment. Would not such a demand be deemed in law a proper presentment, although the street separated the person holding the note and the actual place of payment? Can it make any substantial difference because the person holding the note happens to be some blocks away, provided he is able to reach the maker over the telephone and talk directly to him in that way?" Gilpin vs. Savage, New York Supreme Court, Erie County Trial Term, 112 N. Y. Supp. 802.

CITY NOT BOUND BY CONTRACT WITH TELEPHONE COMPANY ALLOWING COMPANY TO MAINTAIN FIXED SCALE OF CHARGES.—A city cannot, unless it is so expressly authorized by statute, enter into a valid contract with a telephone company, authorizing the company to maintain a certain scale of charges, thereby surrendering a power of government vested in the city by its charter. This is the gist of a recent decision of the Supreme Court of the United States in which the Home Telephone & Telegraph Company brought suit against the city of Los Angeles to restrain the enforcement of municipal ordinances reducing the maximum telephone rate. The city derived its power to regulate telephone charges from section 31 of its charter, whcih authorized it, among other things, "by ordinance . . . to regulate telephone service and the use of telephones within the city . . . and to fix and determine the charges for telephones and telephone service and connections." A franchise for 50 years was granted by the city to the company by an ordinance, which stipulated for certain free service for the city, and the payment to it, after five years, of 2 per ecnt of the gross receipts, and provided that charges to the public for services should not exceed certain specified amounts. The city subsequently enacted an ordinance reducing the maximum rates allowable, which ordinance was objected to by the company on the ground that it impaired the obligation of the contract between it and the city. The question presented was whether the city had power to enter into the contract with the company fixing, unalterably, during the term of the franchise, charges for telephone service, and disabling itself from exercising the charter power of regulation. The following is quoted from the opinion of Mr. Justice Moody, who delivered the opinion of the court: "It has been settled by this court that the State may authorize one of its municipal corporations to establish, by an inviolable contract, the rates to be charged by a public service corporation (or natural person) for a definite term, not grossly unreasonable in point of time, and that the effect of such a contract is to suspend, during the life of the contract, the government power of fixing and regulating the rates. But for the very reason that such a contract has the effect of extinguishing protanto an undoubted power of government, both its existence and the authority to make it must clearly and unmistakably appear, and all doubts must be resolved in favor of the continuance of the power."

"The facts in this case which seem to us material upon the questions of the authority of the city to contract for rates to be maintained during the term of the franchise are as follows: The charter gave to the Council the power 'by ordinance . . . to regulate telephone service and the use of telephones within the city . . . and to fix and determine the charges for telephones and telephone service and connections.' This is an ample authority to exercise the governmental power of regulating charges, but it is no authority to enter into a contract to abandon the governmental power itself. It speaks in words appropriate to describe the authority to exercise the governmental power, but entirely unfitted to describe the authority to contract. It authorizes command, but not agreement. Doubtless an agreement as to rates might be authorized by the Legislature to be made by ordinance. But the ordinance here described was not an ordinance 'to fix and determine the charges.' It authorizes the exercise of the governmental power, and nothing else. We find no other provision in the charter which, by any possibility, can be held to authorize a contract upon this important and vital subject." Home Telephone & Telegraph Company v. Los Angeles, United States Supreme Court, Nov. 30, 1908.

Obituary.

MR. H. F. KELLOGG.—The death occurred at Newton, Mass., on Jan. 16 of Mr. H. F. Kellogg, well known as the New England representative of the Hoyt Electrical Instrument Company, of Pennacook, N. H. Mr. J. A. Massill, the superintendent of the company, writes us: "We feel that in his death we have lost a warm personal friend and valued business associate."

MR. LUCIUS T. GIBBS, electrical engineer of the Baltimore & Ohio Railroad, died on Jan. 22 of pneumonia after an illness of about a week. Mr. Gibbs is survived by a widow, who was Miss A. S. Duer, of Baltimore, and two children. Mr. Gibbs served as an apprentice in the machine shop of the Otis Elevator Company, and was assistant to the mechanical engineer of the Chicago, Milwaukee & St. Paul Railway. He was graduated from Cornell University in 1891 and was afterward made electrical engineer of the Milwaukee Street Railway Company. He was also vice-president and chief engineer of the Gibbs Electric Company of Milwaukee.

Personal.

MR. JAMES N. WALLACE has been elected a director of the Brooklyn Rapid Transit Company to succeed the late Mr. Anson R. Flower.

MR. FRANK AUSTIN, formerly of Mount Holly, N. J., has been appointed general manager and treasurer of the Capital Gas & Electric Company, of Frankfort, Ky.

MR. LOUIS A. FERGUSON, president of the American Institute of Electrical Engineers, has been elected one of the directors-at-large of the Chicago Association of Commerce.

MR. ETIENNE DE FODOR, general manager of the Budapest General Electric Company, has been honored by the King of Hungary with the title of Privy Councillor, in recognition of distinguished services rendered to his country.

MR. B. V. SWENSON, secretary of the American Street & Interurban Railway Association, has resigned to accept an attractive offer to engage in business in the electric railway field. Mr. Swenson will not entirely sever his connection with the association until his successor has been appointed.

MR. H. C. EDDY has resigned as district manager in Chicago for the American District Steam Company, but still remains one of the directors

of the company. Mr. Eddy began his electrical experience with the old Sprague Electric Railway & Motor Company and was for some time connected with the Western Electric Company. A number of years ago he was Western representative of the *Electrical World* and afterward of the *Street Railway Journal*. Subsequently he was associated with Mr. J. H. Cooke in the Chicago office of the Buckeye and Jandus Electric companies. After Feb. 15 Mr. Eddy will have an office at 412 Commercial National Bank Building, Chicago, for the sale of bonds, particularly of public-service corporations.

MR. C. G. YOUNG, who has been so intimately connected with the J. G. White interests for the past 16 years, is opening offices for himself at 60 Wall Street, New York, N. Y., for engineering examinations, estimates, reports, etc. Having important work of this kind to do in the Far East, he is sailing early in February for Japan, and, after visiting other countries, will return in August and take up a regular practice. His address until departure will be 43 Exchange Place, New York, N. Y. After an academic education, Mr. Young entered the old Schuyler electric factory at Middletown, Conn., in 1886, and went through all the branches of electric lighting, manufacture and construction. From 1888 until 1892 he was general superintendent of the Mount Morris Electric Lighting Company in New York, whose extensive system is now owned by the New York Edison Company. In 1892 he began his connection with the White-Crosby and J. G. White interests as construction superintendent, and in 1900 he went with J. G. White & Company, Ltd., of London, doing special expert work all over the world for it, especially in South America. Returning to this country, Mr. White since 1902 has been successively general superintendent of construction and construction manager for the American White corporations. In this manner Mr. Young has done important work in a great many cities in this country, as well as in the Philippines, Australia, Holland, Argentine Republic, Ceylon, Cuba, Canada, Uruguay, Brazil, Porto Rico, China, Chili, New Zealand and Japan. Mr. Young takes an active part in the general field of professional endeavor, and is a member of the American Institute of Electrical Engineers, associate member American Society of Civil Engineers, member of the New York Railroad Club, the New York Electrical Society, the National Electric Light Association and the Engineers' Club.

MR. C. G. YOUNG.

Trade Publications.

THE F. BISSELL COMPANY, Toledo, Ohio, is sending out a February calendar card bearing the symbolic axle.

CONCRETE FACTORY BUILDINGS.—The Turner Construction Company, 11 Broadway, New York, has issued bulletin No. 6, devoted to reinforced concrete factories and warehouses, and giving illustrations and descriptions of structures erected for J. B. King & Co., in New York City, and on Long Island.

WATT-HOUR AND AMP.-HOUR METERS are briefly noted and listed in publication No. 579 of Veritys, Ltd., 31 King Street, Covent Garden, W. C., London. It is claimed that these meters are unaffected by vibration, and may be shipped with assurance that they will be ready for immediate use upon arrival.

INSTRUMENTS.—The January, 1909, issue of the *Foxboro Recorder*, which is Vol I, No. 1, of this publication, announces the formation of the Industrial Instrument Company, with main office at Foxboro, Mass., to serve as sales company of the Standard Gauge Manufacturing Company and sales agent for the Standard Electric Time Company.

SMALL STATION SWITCHBOARDS.—A publication of considerable interest to central-station managers has been issued by the General Electric Company under the above title. The pamphlet discusses only representative cases, pointing out both the desirable and the undesirable features. The bulletin, numbered 4638, goes into details, giving the arrangements, dimensions and connections of various styles of boards.

WIRELESS TELEPHONY.—The De Forest standard navy type wireless telephone devices are described in bulletin D-1 of the Radio Telephone Company, 49 Exchange Place, New York. The Seibt wave meter is dealt with in bulletin G-1. Bulletin J-1 is devoted to variable inductance tuners, and bulletin J-2 to R. J. wave meters. A small variometer for changing the self-induction of oscillatory circuits described in bulletin L-3, while bulletin S-1 relates to school and demonstration telegraph and telephone outfits.

HARVARD SPECIALTIES.—The Harvard Electric Company, 66 West Van Buren Street, Chicago, and 136 Liberty Street, New York City, manufacturers of electrical necessities, has issued a new catalog (No. 17) which is descriptive of a part of the many electrical necessities made by the Harvard company. This publication is the forerunner of a new series of printed matter illustrating Harvard "Dependable Electrical Necessities." Catalog No. 17 describes Harvard patent steel brackets, beveled-edge self-welding wire joints, sectional switch boxes, etc.

FLASHLIGHT ENGINE INDICATOR.—A catalogue of the Dobbie-McInnes, Ltd., 5 Bothwell Street, Glasgow, Scotland, deals with an interesting form of engine indicator, in which the usual multiplying parallel motion is dispensed with and a beam of light is substituted therefor. The motion is received from the rocking of a mirror bracket positively connected by linkage to the engine; the beam reflected from the mirror traces out the indicator diagram on a glass screen for immediate observance on a photographic plate for preservation.

ROLLER BEARING TROLLEY BASE.—In Bulletin No. 4642, just issued by the General Electric Company, is described a new trolley base designed for the increased speed of interurban cars and the consequent severe conditions. The base is light, strong and so sensitive that it not only permits of sharp turns at high speed without danger of throwing the trolley off, but by eliminating the arcing, pounding and wrenching insures a minimum wear on trolley wheels. The bulletin contains a complete description, including illustrations and dimensions.

GREASE VERSUS OIL.—An attractive brochure is printed by the Keystone Lubricating Company, Philadelphia, bearing the above title and containing comparisons of the efficiency of the two great types of lubricant that are used to grease the wheels of industry. Some of the inner reasons for the extensive use of the liquid lubricant, oil, at the present day, to do the work that should properly be done by grease, are explained; and the evolution of "Keystone Grease," stated to be a pure, natural product free from the harmful ingredients and objectionable features of ordinary grease, are set forth. A feature of the argument for Keystone grease is an account of exhaustive tests made by the head chemist of Messrs. William Cramp & Sons, the Philadelphia shipbuilders, on the chemical constitution and mechanical and anti-friction qualities of the product. This booklet may be obtained gratis on application to the home office of the company, Philadelphia, or to any of its agencies.

Business Notes.

THE ECONOMICAL ELECTRIC LAMP COMPANY has removed from 96 Warren Street, New York City, to 25 West Broadway.

THE STANDARD ASPHALT & RUBBER COMPANY will remove its general offices to Suite 508-511, Home Insurance Building, 205 LaSalle Street, Chicago.

THE H. B. KIRKLAND COMPANY, 253 Broadway, New York, N. Y., has been appointed the New York sales agent for the product of the Chicago Mica Company.

THE PELTON WATER WHEEL COMPANY announces the removal of its executive and sales offices from Nineteenth and Harrison Streets to the Monadnock Building, Third and Market Streets, San Farncisco.

THE BALL ENGINE COMPANY, of Erie, Pa., in order better to serve its increasing clientage in the Southern States, has opened an office in the Empire Building, Atlanta, Ga., with Mr. B. C. Fennell, M. E., as sales manager.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia, has recently got up an attractive paper weight showing on one side a picture of the "Exide" battery and on the reverse side a general view of the offices and works.

W. F. LEGGETT COMPANY, INCORPORATED, is the title of a new corporation which succeeds to the business formerly operated by W. F. Leggett, at 56 Pine Street, New York. The address of the new concern will be 39-43 Gold Street, New York.

THE CONDIT ELECTRICAL MANUFACTURING COMPANY, Boston, Mass., reports that the new year opens with a business boom for it, and that recently some very large contracts among mills of the Middle West have been closed, and others are being completed.

ALABAMA ELECTRIC COMPANY, Birmingham, Ala., is the style of a newly organized concern which will carry on a general engineering and contracting business. The company also expects to carry a complete line of pictures. The manager of the new business is Mr. J. A. Swanton.

A CLEVER CALENDAR.—The February calendar card of The F. Bissell Company, Toledo, Ohio, has attached a miniature axe which can be removed and pinned to a coat lapel, and to which point is given by the remark: "It cuts no ice with us whether the job is large or small—we'll handle it in a satisfactory manner."

NORTHERN ENGINEERING WORKS, Detroit, Mich., have recently supplied traveling cranes to the Black Hills Traction Company, of Deadwood, S. D.; one three-ton to the New Phoenix Foundry & Machine Company, of Springfield, Mo.; one 15-ton to the city of Oswego, N. Y., and two 7½-ton traveling cranes to the Western New York Construction Company, of Buffalo, N. Y.

THE SOUTHERN ENGINEERING & SUPPLY COMPANY, has opened offices at 220 Avenue D, Henry Terrell Building, San Antonio, Tex. It proposes to make a specialty of pumping and refrigerating machinery; also isolated and small light and refrigerating plants. Manufacturers interested in southwestern territory not having representatives are requested to send catalogs and descriptive literature.

THE LIBERTY MANUFACTURING COMPANY, Pittsburgh, Pa., informs us that the arrangement it had with the Advance Packing & Supply Company to handle its Chicago business has been terminated and that it has opened an office at 1201 Manhattan Building, Chicago, in

charge of its own representatives. Mr. W. M. Burns and Mr. G. M. Porter will look after its interests in the future in the Chicago territory.

THE NILES CAR & MANUFACTURING COMPANY, Niles, Ohio, held its annual meeting Jan. 26 at the works. The old board of directors and officers were re-elected and the usual dividends of 8 per cent on the preferred and 6 per cent on the common stock were declared. President Robbins' report showed that, while the output for 1908 was less than 50 per cent of that of 1907, it was all taken at a fair profit and a substantial balance was added to the surplus.

ASH-HANDLING PLANTS.—The U. S. Navy Department has awarded a contract for an ash-handling and storage plant for the Navy Yard at Charleston, S. C., to the Darley Engineering Company, 149 Broadway, New York. The contract calls for an 8-in. suction conveyor with a 25-ton storage tank. This is the fourth order the Darley Engineering Company has received from the government for its suction ash conveyor since last May, the others being for the navy yards at New York and Philadelphia, and for the Soldiers' Home at Washington. Armour & Company have just awarded to the same company, through its Chicago office, a contract for an 8-in. suction ash conveyor for their South Omaha plant. This makes the fourth order for suction conveyors awarded by Armour & Company to the Darley Engineering Company, the other plants being installed at the Chicago Glue Works, East St. Louis Packing Plant and the Sioux City Packing Company. A recent order from the American Steel & Wire Company for an 8-in. suction ash conveyor for its Rankin plant makes the third order for these conveyors so far from the United States Steel Corporation and two orders from the American Steel & Wire Company. The Quincy Market Cold Storage & Warehouse Company, Boston, Mass., has just placed an order for an 8-in. suction ash conveyor for its Richmond Street plant.

DIRECTORY OF ELECTRICAL ASSOCIATIONS, SOCIETIES, ETC.

Alabama Light & Traction Association. Secretary, Lloyd Lyon, Mobile, Ala.

American Association of Electric Motor Manufacturers. Secretary, W. H. Tapley, 29 West 39th St., New York.

American Electro-Therapeutic Association. Secretary, Dr. Albert C. Geyser, Willis Ave., New York City.

American Electrochemical Society. Secretary, Prof. J. W. Richards, Lehigh University, South Bethlehem, Pa. Next meeting, Niagara Falls, Canada, May 6, 7 and 8, 1909.

American Institute of Electrical Engineers. Secretary, Ralph W. Pope, United Engineering Societies Building, 29 West 39th St., New York. Meetings, second Friday of each month, excepting June, July, August and September.

Association of Iron and Steel Electrical Engineers. Secretary, G. H. Winslow, 559 Frick Building Annex, Pittsburg, Pa. Next meeting, October, 1908.

Association of Railway Telegraph Superintendents. Secretary, P. W. Drew, Room 511, Harvester Building, Chicago. Next meeting, Detroit, June 23, 24 and 25, 1909.

American Street & Interurban Railway Engineering Association. Secretary, Walter S. Mower, London, Ont.

American Street & Interurban Railway Association. Secretary, B. V. Swenson, United Engineering Societies Building, 29 West 39th St., New York.

Association of Car Lighting Engineers. Secretary, G. B. Colegrove, Chicago & Illinois Railroad, Electrical Department, Chicago. Next meeting, Chicago, Oct. 5, 6, 7 and 8, 1909.

Association of Edison Illuminating Companies. Secretary, S. E. Mumford, Detroit, Mich.

Association of Electric Lighting Engineers of New England. Secretary, W. H. Cole, Waltham, Mass. Annual meetings held in Boston, third Wednesday in March.

Canadian Electrical Association. Secretary, T. S. Young, 104 Confederation Life Building, Toronto, Ont.

Canadian Street Railway Association. Secretary, Allan H. Royce, 48 King St., W., Toronto, Ont.

Central Electric Railway Association. Secretary, A. L. Neereamer, Indianapolis, Ind.

Chicago Electric Club. Secretary, S. M. McFedries, care J. L. Schureman & Co., Chicago.

Colorado Electric Light, Power & Railway Association. Secretary, J. C. Lawler, Colorado Springs, Col. Next meeting, September, 1909.

Eastern States Independent Telephone Association of Pennsylvania, New Jersey, Maryland and Delaware. Secretary, H. E. Bradley, 135 South Second St., Philadelphia, Pa.

Electrical Contractors' Association of New York State. Secretary, Geo. W. Russell, Jr., 500 Fifth Ave., New York.

Electrical Contractors' Association of State of Missouri. Secretary, Charles J. Sutter, 1220 Pine St., St. Louis, Mo.

Electrical Salesmen's Association. Secretary, Francis Raymond, 209 State St., Room 1002, Chicago. Annual meeting, Chicago, January, each year.

Electrical Trades Association of Canada. Secretary, William R. Staveley, Royal Insurance Building, Montreal, Can.

Electrical Trades Association of Chicago. Secretary, Frederick P. Vose, Marquette Building, Chicago. Next meeting, Chicago, Nov. 4, 1909.

Electrical Trades Association of Philadelphia. Secretary, E. A. Symmes, 1324 Land Title Building, Philadelphia, Pa. Meetings, second and fourth Thursdays of each month.

Electrical Trades Association of the Pacific Coast. Secretary, Albert H. Elliott, Harding Building, 34 Ellis St., San Francisco, Cal. Monthly meetings, San Francisco, first Thursday of each month.

Electrical Trades Society of New York (Member National Electrical Trades Association). Secretary, Franz Neilson, 80 Wall St., New York. Board of Directors meets second Friday of each month.

Empire State Gas & Electric Association. Secretary, Charles H. B. Chapin, 154 Nassau St., New York.

Illinois State Electric Association. Secretary, H. E. Chubbuck, Peoria, Ill.

Illuminating Engineering Society. Secretary, V. R. Lansingh, 33 West 39th St., New York. Sections in New York, New England, Philadelphia and Chicago.

Independent Electrical Contractors' Association of Greater New York. Secretary, Lewis H. Woods, Imperial Hotel, Broadway and 32d St., New York.

Independent Telephone Association of Southern Indiana. Secretary, E. W. Landgrebe, Huntingburg, Ind.

International Association of Municipal Electricians. Secretary, Frank P. Foster, Corning, N. Y. Next meeting, Atlantic City, N. J., 1909.

International Electrotechnical Commission (international body representing various national electrical engineering societies contributing to its support). Secretary, C. le Maistre, 28 Victoria St., Westminster, London, S. W., Eng.

International Independent Telephone Association. Secretary, A. C. Davis.

Iowa Electrical Association. Secretary, W. N. Keiser, Des Moines, Ia. Next meeting, Cedar Rapids, Ia., April 21 and 22, 1909.

Iowa Independent Telephone Association. Secretary, W. J. Thill, 208 Des Moines Life Bldg., Des Moines, Ia. Next meeting, Des Moines, March 9, 10 and 11, 1909.

Iowa Street & Interurban Association. Secretary, L. D. Mathes, Dubuque, Ia. Next meeting, Cedar Rapids, Ia., April, 1909.

Kansas Gas, Water & Electric Light Association. Secretary, James D. Nicholson, Newton, Kan. Next meeting, Wichita, Kan., October, 1909.

Kentucky Independent Telephone Association. Secretary, James Maret, Mount Vernon, Ky. Regular meetings, second Tuesday in October, each year.

Massachusetts Street Railway Association. Secretary, Charles S. Clark, 70 Kilby St., Boston, Mass. Meets second Wednesday of each month, except July and August.

Michigan Electrical Association. Secretary, A. C. Marshall, Port Huron, Mich.

Minnesota Electrical Association. Secretary-Treasurer, Ludwig Kemper, Albert Lea, Minn. Next meeting, Nicollet Hotel, Minneapolis, Minn., March 18 and 19, 1909.

Mississippi Electric Association. Secretary, J. A. Abbott, Jackson Ry. & Light Co., Jackson, Miss. Next meeting, Jackson, Miss., June 15, 1909.

Missouri Independent Telephone Association. Secretary, G. W. Schweer, Windsor, Mo.

Missouri Electric Light, Gas & Street Railway Association. Secretary, C. L. Clary, Sikeston, Mo. Next meeting, April 15, 16 and 17, 1909.

National Arm, Pin & Bracket Association. Secretary, J. B. Magers, Madison, Ind.

National Electric Light Association. Secretary, John F. Gilchrist, 139 Adams St., Chicago. Headquarters, 33 West 39th St., New York.

National Electrical Contractors' Association of the United States. Secretary, W. H. Morton, 41 Martin Building, Utica, N. Y. Next meeting, Toledo, Ohio, July 21, 1909.

National Electrical Inspectors' Association. Secretary, T. H. Day, 27 Pliny St., Hartford, Conn.

National Electrical Trades Association. Secretary, Fred. P. Vose, 1343 Marquette Building, Chicago. Next meeting, Boston, Mass., June 10, 1909.

Nebraska Electrical Association. Secretary, William Bradford, Lincoln, Neb.

New England Electrical Trades Association. Secretary, Alton F. Tupper, 84 State St., Boston, Mass. Directors meet first Wednesday of each month.

New England Street Railway Club. Secretary, John J. Lane, 12 Pearl St., Boston, Mass. Meets last Thursday of each month.

NEW YORK ELECTRICAL SOCIETY. Secretary, G. H. Guy, 33 West 39th St., New York.

NEW YORK STATE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, R. M. Eaton, Niagara Falls, N. Y.

NORTHWEST ELECTRIC LIGHT & POWER ASSOCIATION. Temporary chairman, J. D. Crary, Aberdeen, Wash. Next meeting, Seattle, 1909.

NORTHWESTERN ELECTRICAL ASSOCIATION. Secretary, John S. Allen, Lake Geneva, Wis.

OHIO ELECTRIC LIGHT ASSOCIATION. Secretary, D. L. Gaskill, Greenville, Ohio.

OHIO INDEPENDENT TELEPHONE ASSOCIATION. Secretary, Ralph Reamer, Columbus, Ohio. Next meeting, Columbus, Ohio, March 18, 1909.

OHIO SOCIETY OF MECHANICAL, ELECTRICAL & STEAM ENGINEERS. Secretary, David Gaehr, Schofield Building, Cleveland, Ohio. Next meeting, Canton, Ohio, May 21 and 22, 1909.

OKLAHOMA ELECTRIC LIGHT, RAILWAY & GAS ASSOCIATION. Secretary, Galen Crow, Guthrie, Okla.

OLD TIME TELEGRAPHERS' & HISTORICAL ASSOCIATION. Secretary, F. J. Scherrer, 195 Broadway, New York. Next meeting, Pittsburg, Pa., 1909.

PENNSYLVANIA ELECTRIC ASSOCIATION. E. L. Smith, Towanda, Pa., secretary.

PIKE'S PEAK POLYTECHNIC SOCIETY. Secretary, E. A. Sawyer, Colorado Springs, Col. Meeting second Saturday of each month.

SOCIETY FOR THE PROMOTION OF ENGINEERING EDUCATION. Secretary, Arthur L. Williston, Pratt Institute, Brooklyn, N. Y.

SOCIETY OF WIRELESS TELEGRAPH ENGINEERS. Secretary, C. E. Russell, Boston, Mass. Monthly meetings, fourth Monday each month. Next annual meeting, fourth Monday in February, 1909.

SOUTH DAKOTA INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. R. Buck, Hudson, S. D.

SOUTHWESTERN ELECTRICAL & GAS ASSOCIATION. Secretary, J. A. Myler, Jr., 609 Juanita Building, Dallas, Tex. Next meeting, Dallas, Tex., May, 1909.

STREET RAILWAY ACCOUNTANTS' ASSOCIATION OF AMERICA. Secretary, E. M. White, Box 345, Hartford, Conn.

STREET RAILWAY ASSOCIATION OF THE STATE OF NEW YORK. Secretary, J. H. Pardee, Canandaigua, N. Y.

VERMONT & NEW HAMPSHIRE INDEPENDENT TELEPHONE ASSOCIATION. Secretary, E. B. Seeley, St. Johnsbury, Vt.

VERMONT ELECTRICAL ASSOCIATION. Secretary, A. B. Marsden, Manchester, Vt.

UNDERWRITERS' NATIONAL ELECTRICAL ASSOCIATION. Secretary, Electrical Committee, C. M. Goddard, 141 Milk St., Boston, Mass. Next meeting, New York, March, 1909.

WESTERN ASSOCIATION OF ELECTRICAL INSPECTORS. Secretary, W. S. Boyd, 125 Monroe St., Chicago, Ill. Next meeting, Detroit, Mich., October, 1909.

WESTERN SOCIETY OF ENGINEERS. Electrical Section, formerly Chicago Electrical Association. Secretary, J. H. Warder, 1737 Monadnock Block, Chicago. Regular meetings, first Friday of each month, except January, July and August. Annual meeting, first Tuesday after Jan. 1 each year.

Weekly Record of Electrical Patents

UNITED STATES PATENTS ISSUED JAN. 26, 1909.

[Conducted by William F. Bissing, Patent Law, 2 Rector St., N. Y.City.]

910,495. MEANS FOR THE PURIFICATION OF WATER; D. L. V. Brown, San Francisco, Cal. App. filed Oct. 21, 1907. Softens water by electrolysis. Uses a series of anodes and cathodes in the tank made of various metals, such as iron, zinc, etc., together with a series of carbon anodes and cathodes.

910,498. PROCESS OF MANUFACTURING CHEMICAL COMPOUNDS; Courtland F. Carrier, Jr., Elmira, N. Y. App. filed June 5, 1906. The process of making compounds of the alkali metals which consists in subjecting a fused bath containing a salt of the metal which will react with the metal to form the desired product, to electrolysis. A soluble anode, comprising a fused alloy of the metal, and a metallic electrode which is electro-negative to the anode form the means for introducing the current.

910,548. ELECTRIC METER; R. C. Lanphier, Springfield, Ill. App. filed Aug. 23, 1905. The rotating element is submerged in mercury. An independent metallic damping disk with a permanent magnet acts as a brake in such a way that the braking effect is much greater than the damping effect produced by the shunt coils upon the driving disk.

910,549. ELECTRICAL INDICATING INSTRUMENT; R. C. Lanphier, Springfield, Ill. App. filed Sept. 21, 1907. A volt, ampere or watt-meter for alternating or direct current of the mercury motor meter type. The armature is so shaped that its successive radii diminish in length as the disk rotates. This eliminates the operation of the normal law of squares on the indicating finger.

910,550. MOTOR-METER FOR ALTERNATING CURRENTS; R. C. Lanphier and J. H. Hodele, Springfield, Ill. App. filed July 6, 1908. Improvement in mercury meters in which the initial friction is overcome so as to avoid creeping on no load when the voltage rises. Makes use of a primary and secondary of a transformer, the former across the load circuit and the latter provided with a two-branch circuit having auxiliary windings which pass around the load exciting magnet in opposite directions. An adjustable resistance is interposed in the circuit of the secondary whereby the volume of current flowing through the divided circuit may be varied.

910,561. CONTROLLER; J. F. Menningen, Oakley, O. App. filed Dec. 30, 1907. A spring-pressed cam is provided which co-operates with the parts moved by the handle of the controller and which biases the controller through the off position when the controller is at the starting position and in certain other positions. This throws the controller back to off position if the operator releases the handle when starting.

910,581. ELECTRIC FURNACE; James Henry Reid, Newark, N. J. App. filed Aug. 22, 1908. An electric furnace having a pair of arcing electrodes and a pair of neutral resistance elements with contacting ends extending between the electrodes. The ore and reducing agent are fed to the electrodes from a hopper above the furnace.

910,582. ELECTRIC FURNACE; James Henry Reid, Newark, N. J. App. filed Nov. 9, 1908. Polyphase current is supplied to the furnace by means of a plurality of converging electrodes with different phases of the current flowing through each. A neutral electrode extends into the top of the charge supported on the converging electrodes.

910,593. ELECTRIC BLOCK-SIGNAL SYSTEM; Paul J. Simmen, Los Angeles, Cal. App. filed April 22, 1908. Fixes the responsibility in an accident on the engineer in the cab if he fails to obey signals by arranging a series of recording devices corresponding to the respective signaling devices in the cab which are actuated by mechanisms arranged along the track.

910,596. TROLLEY CUT-OUT; Francis M. Spaid and Fred. F. Green, Buffalo, O. App. filed Feb. 27, 1907. Especially for mines. Automatically throws a trolley cut-out into open position immediately after the passage of a motor car in order to permit the following detached cars to take the switch.

910,603. TELEPHONE RECEIVER; Alfred Stromberg, Chicago, Ill. App. filed Oct. 2, 1906. The diaphragm is provided with a reinforced edge consisting of a ring of brass.

910,604. SYSTEM OF CONTROL; E. W. Stull, Norwood, O. App. filed June 8, 1906. Series parallel controller. Arcing is reduced and an interlocking arrangement provided between the controlling drum and reversing switch so as to prevent improper handling. The controller comprises a single drum which is arranged to vary the resistance and to connect the motors, in series, in multiple series and in full multiple.

910,622. AUDIPHONE-TRANSMITTER; Charles E. Williams, Natick, Mass. App. filed Aug. 6, 1907. The instrument is suspended in front of a sounding board. It is provided with a resilient back and the sound is intensified thereby.

910,638. ALTERNATING-CURRENT-MOTOR SYSTEM; C. S. Bradley, New York, N. Y. App. filed May 7, 1906. Controls the capacity in circuit with the secondary of a motor generator, automatically, by means of a centrifugal governor connected to the motor generator.

910,643. APPARATUS FOR MAGNETIC TREATMENT OF DISEASES; R. S. Clymer, Allentown, Pa. App. filed Dec. 27, 1907. Magnetic pole pieces covered with sponge are connected by flexible magnetic strands of magnetic material to electromagnets.

910,649. REGULATION OF DYNAMO-ELECTRIC MACHINES; W. F. Dawson, Schenectady, N. Y. App. filed July 2, 1902. Particularly for boosters which will maintain a practically constant voltage at some point on the system regardless of the load. The series wound booster is provided with an additional shunt winding connected to the main. The booster is located in a feeder extending from the mains. The shunt winding, which is in series with an adjustable resistance, is controlled by a magnet through the variation in voltage at the end of the feeder.

910,658. SYSTEM OF LIGHTING BY ARC-LAMPS; R. Fleming, Lynn, Mass. App. filed March 6, 1907. An alternating current circuit having a pair of arc-lamps in it, each having dissimilar electrodes. The rectifying action produced thereby is avoided by connecting half the total number of lamps reversely with respect to the others.

910,661. CIRCUIT-CONTROLLING DEVICE; H. Geisenhoner, Schenectady, N. Y. App. filed Jan. 14, 1907. For starting and controlling the speed of electric motors, such as fans. A device actuated by wind pressure from the motor cuts out resistance.

910,664. MAGNETIC SEPARATOR; C. M. Green, Lynn, Mass. App. filed Dec. 10, 1904. A magnetic separator consisting of two massive iron rollers journaled horizontally in a frame with peripheral teeth.

910,670. ARC-LAMP; C. A. B. Halvorson, Jr., Lynn, Mass. App. filed Jan. 16, 1907. Either one or both electrodes are consumed in burning. When the lamp is not burning a floating chimney drops down until the upper electrode rests on the lower. The chimney is lifted in striking the arc.

910,676. AUTOMATIC STARTING DEVICE FOR ELECTRIC MOTORS; Ivan Hansen, Malden, Mass. App. filed April 18, 1906. A starting switch which is entirely automatic in its action for starting single-phase motors. The switch breaks the circuit of the phase-splitting starting device and is controlled by two magnets. When the motor speed increases the switch is released.

910,682. ELECTRIC HEATER; G. H. Hill, Schenectady, N. Y. App. filed July 9, 1908. The electric heater includes a heating element, an electromagnetic circuit-closing device therefor arranged to control its own circuit and a thermostat for controlling the circuit of said device.

910,690. DRIVING MECHANISM FOR REGISTERING MACHINES; C. F. Kettering, Dayton, O. App. filed June 9, 1905. An electric motor for driving the cash register, together with a magnetic clutch connecting the motor and the driven member. The keys close the motor circuit.

910,722. CARTRIDGE FOR MINING PURPOSES; E. Purcell and S. Purcell, Pontefract, England. App. filed March 30, 1908. A detonator is placed within the casing of the cartridge, which latter is provided with a light disk having an aperture for the wires of the detonator.

910,725. ELECTRIC HEATING DEVICE; A. E. Reimers, New York, N. Y. App. filed Dec. 26, 1907. An electric heater having a metallic plate with an insulating surface and a central form and distance plate with a high resistance wound partly on the form and partly on the distance plate.

910,730. GUARD-COVERING FOR THIRD RAILS; E. M. Schollenberger, Chicago, Ill. App. filed June 4, 1908. The guard has elastic side walls which may move freely with respect to the rail.

910,736. ELECTRIC LAMP AND METHOD OF MAKING THE SAME; C. P. Steinmetz, Schenectady, N. Y. App. filed Nov. 17, 1902. In order to be able to run a mercury vapor lamp at a high temperature which improves the quality of the light and permits the use of lithium compounds and the like, the inclosing chamber is formed of fused quartz with nickel steel inleads for the current.

910,743. VARIABLE RESISTANCE; E. Thomson, Swampscott, Mass. App. filed Sept. 28, 1905. An improved form of flake resistance of granular silicon. The compression is varied by suitable means.

910,762. AUTOMATIC MOTOR-STARTER; W. C. Yates, Schenectady, N. Y. App. filed May 9, 1908. For alternating-current circuits having a polyphase supply circuit. Uses a plurality of automatically operated switches for first connecting the motor through the supply circuit to a transformer and then connecting the motor directly to the supply circuit, together with a no-voltage magnet responsive to any phase of the circuit.

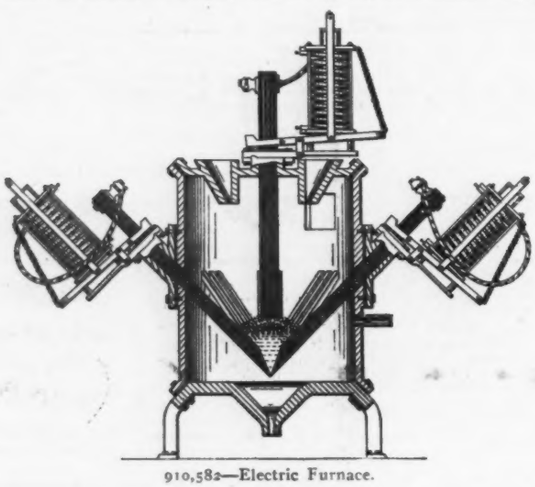
910,765. COMBINED BOX-HANGER AND GROUND-CLAMP; Sol. Adelman, Chicago, Ill. App. filed May 18, 1908. Can be easily attached to completed work without tearing away material. Makes use of a ground clamp having a split sleeve with ears secured to the outlet box.

910,770. RESILIENT FLEXIBLE CONDUIT; Ulysses S. Armstrong, New Kensington, Pa. App. filed Sept. 26, 1907. Recovers its original form after being flattened. Consists of a series of tubes one within the other and made of non-combustible fiber with woven or braided wire.

910,795. RESISTANCE; J. L. Dinsmore, New York, N. Y. App. filed Jan. 29, 1908. Resistance for arc-lamps and the like separated from the electrical structure, comprising a casing, having a perforated base member, a plurality of spools fixed to the base member, the spools overlapping but out of contact.

910,797. TROLLEY-HEAD; W. E. Donnelly and W. L. Goyette, Chicopee Falls, Mass. App. filed April 28, 1908. A detachable wheel holder having a head with a tubular end to receive one end of a pole member and provided with co-operating interlocking means and a nut to engage and draw the parts into interlocked relation.

910,798. ELECTRIC HOIST; W. O. Duntley, Chicago, Ill. App. filed July 30, 1907. Employs a plurality of motors instead of a single motor; a plurality of winding drums, a driving shaft actuated thereby,



910,582—Electric Furnace.

a plurality of motor armatures and a common field magnet for the armatures.

910,799. INSULATOR-PIN; S. J. Edmiston, Greenwich, N. Y. App. filed June 26, 1908. The pin is bifurcated at its lower end to form resilient portions and the lower end has a projection to prevent withdrawal of the pin from a socket.

910,822. SECONDARY BATTERY; H. F. Joel, Forest Gate, England. App. filed Aug. 10, 1907. Cylindrical electrodes are arranged one within the other and are provided with corresponding ribs.

910,835. ELECTRIC SWITCH; B. W. Macy, Orlando, Fla. App. filed Sept. 20, 1907. To light the lights of a house singly or collectively by means of a switch having a casing with contact buttons mounted therein and a shaft operated by a hand crank to select the proper button.

910,842. ELECTRIC-TERMINAL CLIP; G. McIntyre, Jersey City, N. J. App. filed Aug. 2, 1906. One terminal of the loop forms a finger piece and the other terminal also forms a finger piece which may be pressed together to release the loop from the binding post.

910,873. TELEPHONE RINGING SYSTEM FOR PARTY-LINES; C. A. Simpson, Chicago, Ill. App. filed Nov. 30, 1907. Party line system in which the bell is connected in series with a condenser which permits a ringing current to pass for the bell. Avoids discharging all the condensers when the ringing key is released, thus giving a false clearing-out signal. The discharge current is diverted away from the clearing-out signal by a shunt about the coil of the clearing-out signal.

910,892. FIELD-MAGNET OR THE LIKE; C. P. Bary, Neuilly-sur-Seine, France. App. filed Oct. 24, 1905. The magnet has a central part with lateral prolongations, the section of the central part being twice as great as that of each of the lateral prolongations, and the distance between two poles being equal to or less than twice the width of the central part.

910,894. PROCESS OF MAKING TITANIUM ALLOYS; F. M. Becket, Niagara Falls, N. Y. App. filed June 5, 1907. Consists in reducing a titanium ore in an electric furnace by means of carbon in presence of sufficient silicon to exclude from the product carbon in excess of 10 per cent

910,911. RAILWAY SIGNALING MECHANISM; L. H. Craft, Dennison, O. App. filed Sept. 23, 1907. A single-arm three-position blade driven by a gear wheel and controlled by a magnet which actuates a latch to connect the gear to the driving shaft.

910,930. MEDICAL ELECTRICAL DEVICE FOR MEDICAL AND THERAPEUTICAL PURPOSES; F. A. Ligowsky, Cincinnati, O. App. filed Feb. 24, 1908. Glass plates, induction coil batteries, etc., are provided for producing the ozone, together with a clockwork for controlling the action so as to time the generation of ozone.

910,931. ELECTRIC CARRIER SYSTEM; S. H. Libby, East Orange, N. J. App. filed Aug. 1, 1906. For raising and lowering a load at a station and transferring it to another station, where it is again raised and lowered without requiring the attendance of the operator between stations. Makes use of a trolley conductor having an insulated section at each of the stations, a carrier which travels between the stations and a motor on the carrier with suitable switches.

910,949. AUTOMATIC TENSION-REGULATOR FOR ELECTRICAL GENERATORS; A. Nicol, Berlin, Germany. App. filed Jan. 22, 1908. An auxiliary device operating intermittently increases the tension in the exciting circuit and accumulates energy, which again reduces the tension when the device ceases to operate the adjuster.

910,951. CONTROLLER FOR ELECTRIC MOTORS; W. A. Paris, Edgewood Park, Pa. App. filed March 3, 1906. Uses a rotatable contact drum having a plurality of similar groups of contacts, together with a plurality of stationary contacts comprising two electrically connected but independently yielding fingers which engage the drum at points 90 deg. apart.

910,957. BLOCK-SIGNAL; C. H. Roth and H. A. Harrington, Akron, O. App. filed Dec. 6, 1906. Incandescent lamps of different colors used for single-track roads. Controlled by means of a solenoid and plunger from the track.

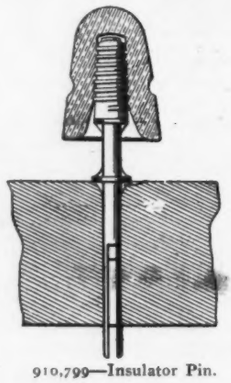
910,964. ROLLER-BEARING FOR ROCKER-RINGS; R. Siegfried, Pittsburgh, Pa. App. filed May 1, 1905. Roller bearings for the rocker-rings that support the commutator brushes of dynamo electric machines. Details.

910,965. CONNECTOR ATTACHMENT FOR BATTERIES; J. F. Siems, Columbus, Neb. App. filed June 24, 1908. A draw-spring having a coil, one end of which is embedded in the battery and which affords means for inserting a connector wire between the coils of the spring. Avoids the use of screws.

910,969. ELECTRIC LAMP AND METHOD OF MAKING THE SAME; C. P. Steinmetz, Schenectady, N. Y. App. filed Nov. 17, 1902. (See 910,736.) The end portions of the enclosing chamber are formed out of fused quartz combined with potassium so as to form glass. This permits the use of the ordinary leading-in wires.

910,975. CLEAT FOR ELECTRIC WIRES; A. L. Vickers, New Sharon, Ia. App. filed Sept. 23, 1907. The cleat has a base with top members mounted on the base, the members being capable of removal independently of one another. The top member thus consists of sections.

910,989. INSULATING COMPOUND; P. J. Cannon, W. H. Young and



910,799—Insulator Pin.

910,842—Electric Terminal Clip.

C. Bateholts, Schenectady, N. Y. App. filed Dec. 26, 1903. The compound can be molded into shape. Consists of 67 parts of ground slate, 10 parts of asbestos, 6 parts of kauri, 10 parts of copal, 5 parts of gilsonite and 2 parts of rosin.

910,991. ELECTRIC STORAGE BATTERY; S. S. Cole, Sandy Hook, Conn. App. filed July 10, 1907. A unit for a storage battery cell having a plurality of apertured electrode plates. Bolts pass through the apertures and connect the plates together .

911,011. MULTIPLE-VOLTAGE SYSTEM OF CONTROL; R. P. Jackson, Wilkinsburg, Pa. App. filed March 3, 1906. May be supplied with alternating current or direct current and with alternating current of two or more voltages. A switch arranges the circuits according to the character of energy supplied. Translating devices are automatically connected to the source of alternating current when the alternating current is supplied to the system.

911,013. MOTOR-CONTROL SYSTEM; H. D. James, Pittsburg, Pa. App. filed May 6, 1907. For driving planers and the like in which the speed of the bed is high in one direction and low on the return. The electric motor has an accelerating resistance with a series of short-circuiting switches for the resistance and means governed by the load for opening the switches to reinsert resistance.

911,016. ALARM SYSTEM; W. H. Kirnan, Bayonne, N. J. App. filed July 30, 1908. A fire alarm system in which signals are received and automatically transmitted to the various engine houses over a joker line or a gong line or simultaneously over both. The apparatus on the gong line can be switched on to and actuated through the joker line and signals sent to either the joker apparatus or gong apparatus when desired when the gong line is broken.

911,018. ELECTRIC APPARATUS; B. J. Lamme, Pittsburg, Pa. App. filed May 6, 1907. For securing the magnetizing winding in the slots of laminated core structures by means of a plurality of coil-retaining blocks disposed in each slot and separated by air spaces and relatively narrow insulating spacers disposed between the blocks to maintain the air spaces.

911,020. MERCURY-MOTOR METER; R. C. Lanphier and O. White, Springfield, Ill. App. filed Aug. 20, 1908. The armature casing is composed of an upper member of insulating material having a circular recess adapted to receive an armature, a lower member composed of a thin plate of non-magnetic material, a clamping ring and means for clamping said upper member, said lower member and said clamping ring firmly together.